

AN
INTRODUCTION
TO THE
NATURAL HISTORY OF FISHES;

BEING THE ARTICLE "ICHTHYOLOGY," FROM THE SEVENTH EDITION

OF THE
ENCYCLOPÆDIA BRITANNICA.

WITH ABOVE ONE HUNDRED AND THIRTY ILLUSTRATIONS.

BY
JAMES WILSON, F.R.S.E. M.W.S.

AND OF THE ENTOMOLOGICAL SOCIETY OF FRANCE.

ADAM AND CHARLES BLACK, EDINBURGH;
SIMPKIN, MARSHALL, & CO., WHITTAKER & CO., AND HAMILTON, ADAMS, & CO.
LONDON; AND JOHN CUMMING, DUBLIN.

M.DCCC.XXXVIII.

Book 57

HARVARD UNIVERSITY.



LIBRARY
OF THE
MUSEUM OF COMPARATIVE ZOÖLOGY

72288

LIBRARY OF
SAMUEL GARMAN

June 8, 1929.

JUN 8 1929

INTRODUCTION

TO THE

NATURAL HISTORY OF FISHES.

AN
INTRODUCTION
TO THE
NATURAL HISTORY OF FISHES;

BEING THE ARTICLE "ICHTHYOLOGY," FROM THE SEVENTH EDITION

OF THE
ENCYCLOPÆDIA BRITANNICA.

WITH ABOVE ONE HUNDRED AND THIRTY ILLUSTRATIONS.

BY
JAMES WILSON, F.R.S.E. M.W.S.

AND OF THE ENTOMOLOGICAL SOCIETY OF FRANCE.

ADAM AND CHARLES BLACK, EDINBURGH;
SIMPKIN, MARSHALL, & CO., WHITTAKER & CO., AND HAMILTON, ADAMS, & CO.
LONDON; AND JOHN CUMMING, DUBLIN.

M.DCCC.XXXVIII.

1871
1872
1873

PREFATORY NOTICE.

THE PROPRIETORS of the *ENCYCLOPÆDIA BRITANNICA* having informed me of their intention to re-publish (in a separate form) the Systematic Treatise on the Class of Fishes, which, under the term *ICHTHYOLOGY*, I some time ago contributed to the Seventh (or current) Edition of that work, I deem it advisable to prefix a Catalogue of the British Species described and figured in Mr Yarrell's recent volumes. These had not approached completion when the article above referred to was concluded; and it will no doubt prove interesting to the student of the general subject to be enabled to perceive the relations which our indigenous species bear to the more gorgeous natives of foreign climes. By referring to the Alphabetical Index which terminates the Treatise, the generic titles of the British Fishes will be found in their systematic order, and the species named, many of which are of familiar occurrence, will thus serve to exemplify the groups to which they respectively belong, and so illustrate the Cuvierian arrangement of the Class.

Of *two hundred and twenty-six* British species, described and figured by Mr Yarrell, we believe that about one fourth part had not been previously included in any catalogue of our indigenous productions; and when we consider that above *six thousand* different kinds of fishes have been already collected in the various waters of the earth (which, from their prevailing continuity and comparative equality of temperature, afford an easy as well as an ample field for migratory movement), we cannot doubt that the spirit of observation which is now afloat will lead to the discovery from time to time of numerous other and most interesting additions along our island shores. The admiration excited by the beautiful illustrations of the "*History of British Fishes*," and the facilities which they afford for the comparison and ascertainment of species, have indeed already conduced to that desired effect;¹ and we believe that Mr Yarrell's manuscript notes will enable him to furnish a great increase of ichthyological information to a second edition of his work, which we take it for granted will be ere long called for.

I shall here only further observe, that the *vexata quæstio* which regards the specific nature and origin of the *Parr*, has been of late discussed with frequency and fulness by several ingenious, and one or two competent, observers. The most important point at issue, viz. the identity of parr and salmon-smolts, has received some curious confirmation from the

¹ See *Transactions of the Royal Society of Edinburgh*, vol. xiv. ; and *Annals of Natural History*, No. iii.

observations and experiments of Mr Shaw, Drumlanrigg,¹—notwithstanding which, however, there are not wanting zealous advocates to maintain the specific distinction of the fish in question. In the present state of the case, I think it unnecessary to qualify the opinions expressed upon the subject in the following Treatise, although I think that Mr Shaw's views regarding the slow growth of salmon fry, and their long continuance in river water, are founded upon too definite data to be disregarded, and that, when confirmed by a more extended series of observations on these creatures in their native streams, they will materially modify the sentiments of naturalists, and eventually lead to an alteration in our fiscal regulations regarding the conservation of the most important of all the species which breed in fresh waters.

The student of Scottish Ichthyology will peruse with interest the descriptive Essay by Dr Parnell, "On the Fishes of the Firth of Forth," at present on the eve of publication.²

J. W.

WOODVILLE, EDINBURGH, *May* 1838.

¹ Account of some experiments and observations on the Parr and on the Ova of the Salmon, proving the Parr to be the young of the Salmon (*Edinburgh New Philosophical Journal* for July 1836). Experiments on the development and growth of the Fry of the Salmon, from the exclusion of the ovum to the age of six months. (Read before the Royal Society on 18th December, and published in the *Edinburgh New Philosophical Journal* for January 1838.)

² *Memoirs of the Wernerian Natural History Society*, vol. vii.

LIST OF BRITISH FISHES.

FIRST GREAT SERIES, CALLED ORDINARY OR OSSEOUS FISHES.

ORDER I.—ACANTHOPTERYGII.

Family Percidæ.

The Perch.	<i>Perca fluviatilis.</i>
The Basse.	<i>Labrax lupus.</i>
The Smooth Serranus.	<i>Serranus cabrilla.</i>
Couch's Serranus.	<i>Serranus Couchii.</i>
The Dusky Serranus.	<i>S. gigas.</i>
The Ruffe or Pope.	<i>Acerina vulgaris.</i>
The Great Weever.	<i>Trachinus draco.</i>
The Lesser Weever.	<i>T. vipera.</i>
The Striped Red Mullet.	<i>Mullus surmuletus.</i>
The Plain Red Mullet.	<i>M. barbatus.</i>

Family Buccæ Loricatæ.

The Red Gurnard.	<i>Trigla cuculus.</i>
The Sapphirine Gurnard.	<i>T. hirundo.</i>
The Piper.	<i>T. lyra.</i>
The Streaked Gurnard.	<i>T. lineata.</i>
The Gray Gurnard.	<i>T. gurnardus.</i>
Bloch's Gurnard.	<i>T. Blochii.</i>
The River Bull-head.	<i>Cottus gobio.</i>
The Sea Scorpion.	<i>C. scorpius.</i>
The Father-lasher.	<i>C. bubalis.</i>
The Four-Horned Cottus.	<i>C. quadricornis.</i>
The Armed Bull-Head.	<i>Aspidophorus Europæus.</i>
The Bergylt.	<i>Sebastes Norvegicus.</i>

The Rough-tailed Stickle-back.	{	<i>Gasterosteus trachurus.</i>
The Half-armed Stickle-back.		
The Smooth-tailed Stickle-back.	{	<i>G. leiurus.</i>
The Short-spined Stickle-back.		
The Four-spined Stickle-back.	{	<i>G. brachycentrus.</i>
The Ten-spined Stickle-back.		
The Fifteen-spined Stickle-back.	{	<i>G. spinulosus.</i>
	{	<i>G. pungitius.</i>
	{	<i>G. spinachia.</i>

Family Scianidæ.

The Maigre.	<i>Sciæna aquila.</i>
The Bearded Umbrina.	<i>Umbrina vulgaris.</i>

Family Sparidæ.

The Gilt-head.	<i>Chrysophrys aurata.</i>
The Braize.	<i>Pagrus vulgaris.</i>
The Spanish Bream.	<i>Pagellus erythrinus.</i>
The Sea Bream.	<i>P. centrodontus.</i>
The Four-toothed sparus.	<i>Dentex vulgaris.</i>
The Black Bream.	<i>Cantharus griseus.</i>

Family Squammipennes.

Ray's Bream.	<i>Brama Raii.</i>
--------------	--------------------

Family Scomberidæ.

The Mackerel.	<i>Scomber scomber.</i>
The Spanish Mackerel.	<i>S. scolias.</i>
The Tunny.	<i>Thynnus vulgaris.</i>
The Bonito.	<i>Th. pelamys.</i>
The Sword-fish.	<i>Xiphias gladius.</i>
The Pilot-fish.	<i>Naucrates ductor.</i>
The Scad.	<i>Caranx trachurus.</i>
The Black-fish.	<i>Centrolophus pompilus.</i>
The Dory.	<i>Zeus faber.</i>
The Boar-fish.	<i>Capros asper.</i>
The Opah or King-fish.	<i>Lampris guttata.</i>

Family Tenioidæ.

The Scabbard-fish.	<i>Lepidopus argyreus.</i>
The Silvery Hair-tail.	<i>Trichiurus lepturus.</i>
Hawken's Gymnetrus.	<i>Gymnetrus Hawkeni.</i>
The Deal-fish.	<i>Gymnetrus arcticus.</i>
The Red Band-fish.	<i>Cepola rubescens.</i>

Family Mugilidæ.

The Gray Mullet.	<i>Mugil capito.</i>
The Thick-lipped Gray Mullet.	<i>Mugil chelo.</i>
The Short Gray Mullet.	<i>Mugil curtus.</i>
The Atherine.	<i>Atherina presbyter.</i>

Family Gobioidæ.

Montagu's Blenny.	<i>Blennius Montagui.</i>
The Ocellated Blenny.	<i>B. ocellaris.</i>
The Gattoruginous Blenny.	<i>B. gattorugine.</i>
The Shanny.	<i>B. pholis.</i>
The Crested Blenny.	<i>B. palmicornis.</i>
The Spotted Gunnel.	<i>Muraenoides guttata.</i>
The Viviparous Blenny.	<i>Zoarcus viviparus.</i>
The Wolf-fish.	<i>Annarrhichus lupus.</i>
The Black Goby.	<i>Gobius niger.</i>
The Doubly-Spotted Goby.	<i>G. bipunctatus.</i>
The Spotted Goby.	<i>G. minutus.</i>
The Slender Goby.	<i>G. gracilis.</i>
The Gemmeous Dragonet.	<i>Callionymus lyra.</i>
The Sordid Dragonet.	<i>C. dracunculus.</i>

Family Pectorales Pediculati.

The Fishing Frog.	<i>Lophius piscatorius.</i>
-------------------	-----------------------------

Family Labridæ.

The Ballan Wrasse.	<i>Labrus maculatus.</i>
The Green Streaked Wrasse.	<i>L. lineatus.</i>
The Blue Striped Wrasse.	<i>L. variegatus.</i>
The Sea-Wife.	<i>L. vetula.</i>
The Red Wrasse.	<i>L. carneus.</i>

The Comber Wrasse.	Labrus comber.
The Rainbow Wrasse.	Julis Mediterranea.
The Gilt-Head.	Crenilabrus tinca.
The Goldfinny.	C. cornubicus.
The Gibbous Wrasse.	C. gibbus.
The Scale-rayed Wrasse.	C. luscus.

Family Fistulariæ.

The Trumpet-fish.	Centriscus scolopax.
-------------------	----------------------

ORDER II.—MALACOPTERYGII ABDOMINALES.

Family Cyprinidæ.

The Common Carp.	Cyprinus carpio.
The Crucian Carp.	C. gibelio.
The Gold Carp.	C. auratus.
The Barbel.	Barbus vulgaris.
The Gudgeon.	Gobio fluviatilis.
The Tench.	Tinca vulgaris.
The Bream.	Abramis brama.
The White Bream.	Abramis blicca.
The Ide.	Leuciscus idus.
The Dobule Roach.	L. dobula.
The Roach.	L. rutilus.
The Dace.	L. vulgaris.
The Graiuing.	L. Lancastriensis.
The Chub.	L. cephalus.
The Red-Eye.	L. erythrothalmus.
The Azurine.	L. cæruleus.
The Bleak.	L. alburnus.
The Minnow.	L. phoxinus.
The Loach.	Cobitis barbatula.
The Spined Loach.	Botia tænia.

Family Esocidæ.

The Pike.	Esox lucius.
The Gar-fish.	Belone vulgaris.
The Saury Pike.	Scomber-esox saurus.
The Flying-fish.	Exocetus volitans.

Family Siluridæ.

The Sly Silurus.	Silurus glanis.
------------------	-----------------

Family Salmonidæ.

The Salmon.	Salmo salar.
The Bull-Trout.	S. eriox.
The Salmon-Trout.	S. trutta.
The Parr.	S. salmulus.
The Common Trout.	S. fario.
The Great Lake Trout.	S. ferox.
The Northern Charr.	S. umbla.
The Welsh Charr.	S. salvelinus.
The Smelt.	Osmerus eperlanus.
The Grayling.	Thymallus vulgaris.
The Gwyniad or Schelly.	Coregonus fera? Cuv.
The Vendace.	C. Willughbii.
The Argentine.	Scopelus Humboldtii.

Family Clupeidæ.

The Pilchard.	Clupea pilchardus.
The Herring.	C. harengus.
Leach's Herring.	C. Leachii.
The Sprat or Garvie.	C. sprattus.
The White-Bait.	C. alba.
The Twaite Shad.	Alosa finta.
The Alice Shad.	A. communis.
The Anchovy.	Engraulis encrasicolus.

ORDER III.—MALACOPTERYGII SUBRACHIATI.

Family Gadidæ.

The Common Cod.	Morhua vulgaris.
The Dorse.	M. callarias.

The Haddock.	Morhua æglefinus.
The Bib.	M. lusca.
The Poor.	M. minuta.
The Speckled Cod.	M. punctata.
The Whiting.	Merlangus vulgaris.
The Coal-Fish.	M. carbonarius.
The Pollack.	M. pollachius.
The Green Cod.	M. virens.
The Hake.	Merluccius vulgaris.
The Ling.	Lota molva.
The Burbot.	L. vulgaris.
The Three-bearded Rock-ling.	Motella vulgaris.
The Five-bearded Rockling.	M. quinquecirrata.
The Mackerel Midge.	M. glauca.
The Silvery Gade.	M. argenteola.
The Torsk or Tusk.	Brosmus vulgaris.
The Forked Hake.	Phycis furcatus.
The Lesser Forked Hake.	Raniceps trifurcatus.

Family Pleuronectidæ.

The Plaice.	Platessa vulgaris.
The Flounder.	Platessa flesus.
The Common Dab.	P. limanda.
The Lemon Dab.	P. microcephalus.
The Long Rough Dab.	P. limandoides.
The Craig Fluke.	P. pola.
The Holibut.	Hippoglossus vulgaris.
The Turbot.	Rhombus marinus.
The Brill.	Rh. vulgaris.
Muller's Topknot.	Rh. hirtus.
Block's Topknot.	Rh. punctatus.
The Whiff.	Rh. megastoma.
The Scald-Fish.	Rh. Arnoglossus.
The Sole.	Solea vulgaris.
The Lemon Sole.	S. pegusa.
The Variegated Sole.	Monochirus linguatulus.

Family Cyclopteridæ.

The Cornish Sucker.	Lepidogaster Cornubiensis.
The Bimaculated Sucker.	L. bimaculatus.
The Lump Sucker.	Cyclopterus lumpus.
The Unctuous Sucker.	Liparis vulgaris.
Montagu's Sucking Fish.	L. Montaguï.

Family Echeuidæ.

The Common Remora.	Echeneis remora.
--------------------	------------------

ORDER IV.—MALACOPTERYGII APODES.

Family Murænidæ.

The Sharp-nosed Eel.	Anguilla acutirostris.
The Broad-nosed Eel.	A. latirostris.
The Snig.	A. mediostris.
The Conger.	Conger vulgaris.
The Muræna.	Muræna Helena.
The Anglesey Morris.	Leptocephalus Morrisii.
The Beardless Ophidium.	Ophidium imberbe.
The Sand-Eel.	Ammodytes Tobianus.
The Sand-Lance.	Am. lancea.

ORDER V.—LOPHOBRANCHII.

Family Syngnathidæ.

The Great Pipe-fish.	Syngnathus acus.
The Deep-nosed Pipe-fish.	S. typhle.
The Æquorial Pipe-fish.	S. æquoreus.
The Snake Pipe-fish.	S. ophidion.
The Worm Pipe-fish.	S. lumbriciformis.
The Short-nosed Hippo-campus.	Hippocampus brevirostris.

ORDER VI.—PLECTOGNATHI.

Family Gymnodontidæ.

Pennant's Globe-fish.	Tetradon Pennantii.
The Short Sun-fish.	Orthogoriscus mola.
The Oblong Sun-fish.	O. oblongus.

Family Balistidæ.

The European File-fish.	Balistes capricus.
-------------------------	--------------------

The Porbeagle.
 The Beaumaris Shark.
 The Common Tope.
 The Smooth Hound.
 The Basking Shark.
 The Picked Dog-fish.
 The Greenland Shark.
 The Hammer Head.
 The Angel-fish.

Lamna cornubicus.
 L. monensis.
 Galeus vulgaris.
 Mustelus lævis.
 Selachus maximus.
 Spinax acanthias.
 Scymnus borcalis.
 Zygaena malleus?
 Squatina angelus.

SECOND GREAT SERIES, CALLED
 CHONDROPTERYGII, OR CARTILAGINOUS
 FISHES.

ORDER I.—BRANCHIÆ FREE.

Family Sturionidæ.

The Common Sturgeon.	Acipenser sturio.
----------------------	-------------------

Family Chimæridæ.

The Northern Chimæra.	Chimæra monstrosa.
-----------------------	--------------------

ORDER II.—BRANCHIÆ FIXED.

Family Squalidæ.

The Small-spotted Dog-Fish.	Scyllium canicula.
The Large-spotted Dog-Fish.	Sc. catulus.
The Black-mouthed Dog-Fish.	Sc. melanostomum.
The White Shark.	Carcharias vulgaris.
The Fox Shark.	C. vulpes.
The Blue Shark.	C. glaucus.

The Electric Ray.
 The Long-nosed Skate.
 The Skate.
 The Sharp-nosed Ray.
 The Bordered Ray.
 The Homelyn Ray.
 The Small-eyed Ray.
 The Thorn Back.
 The Starry Ray.
 The Sting Ray.
 The Eagle Ray.

Torpedo vulgaris.
 Raia chagrinea.
 R. batis.
 R. oxyrhynchus.
 R. marginata.
 R. maculata.
 R. microcellata.
 R. clavata.
 R. radiata.
 Trygon pastinacea.
 Myliobatis aquila.

Family Petromyzidæ.

The Lamprey.	Petromyzon marinus.
The Lampern.	P. fluviatilis.
The Fringed-lipped Lampern.	P. Planeri.
The Pride.	Ammocætes branchialis.
The Myxine.	Gastrobranchus cæcus.
The Lancelet.	Amphioxus lanceolatus.

ICHTHYOLOGY.¹

INTRODUCTORY CHAPTER.

Introduc-
tion.

SECT. I.—DEFINITION AND GENERAL OBSERVATIONS. THE PRINCIPAL EPOCHS IN THE SCIENCE OF ICHTHYOLOGY.

FISHES may be technically defined as *vertebrated animals with red blood, breathing through the medium of water by means of branchie or gills*. This definition, as Baron Cuvier has remarked, is the result of observation; it is a product of analysis, or what is termed in physics an empirical formula; but its accuracy is demonstrable by the inverse method, for, when once duly perceived, we may in a great measure deduce from it a knowledge of the entire nature of the beings to which it is applied. Being vertebrated, they must be possessed of an internal skeleton; of a brain and spinal marrow, enclosed in a vertebral column; of muscles exterior to the bones; of four extremities only; and of the organs of the first four senses, situate in the cavities of the head; with other relations not necessary to be here named.

The greater portion of the surface of the earth is covered by the waters of the translucent sea; and wherever continents and the larger islands protrude their rocky bulk, we find them coursed by flowing rivers, or intersected by lakes and marshes. These present in their aggregate an enormous mass of waters, and afford protection and nourishment to myriads of living creatures, probably superior in number, and in no way inferior in beauty, to those which inhabit the earth. On land, the matter susceptible of life is mainly employed in the construction and continuance of vegetable species; from these herbivorous animals draw their nourishment; and this being animalized by assimilation, becomes an appropriate food for the carnivorous kinds, which scarcely amount to more than one half of the terrestrial creatures of all classes. But in the liquid element, and more especially among the saline waters of the ocean, where the vegetable kingdom is so much more restricted, almost all organized substances are pervaded by animal life, and each lives at the expense of some smaller or feebler foe. There we meet not only with the greatest and most wonderful variety of forms, but also with the extremes in respect to size,—from the myriads of microscopic monads, which, but for artificial means, must have remained for ever invisible and unknown, to the ponderous whale, which surpasses by twenty times the bulk of the largest elephant. There, too, we may discover the majority of those magnificent combinations of organic structure, on the relations of which naturalists have established the distinction of classes, or great primary groups,—in other words, the sea may be said to contain representatives of each; for, even among birds, those aerial creatures which usually inhabit so light an element, we find species so constructed as

to dwell almost for ever on its waves. The mammiferous class is still more fully represented in the numerous tribes of seals, morses, manaties, and whales, all of which require a moist abode, and some of which immediately perish when deprived of it. Most reptiles are aquatic, many insects are so, more particularly in their larva state; and almost all the Mollusca, the Annelides, the Crustacea, and Zoophytes,—four great classes, which on terra firma are few and far between,—exist in countless numbers in the waters of the ocean. Hence that ancient dictum recorded by Pliny, “*Quicquid nascatur in parte naturæ ulla, et in mari esse; præterque multa quæ nusquam alibi.*”

But amongst all the teeming wonders which vivify the vast expanse and liquid depth of waters, none so predominate, or are so truly characteristic, as the subjects of our present treatise; nor are any more worthy of our devoted consideration, whether we regard the beauty or eccentricity of their forms, the metallic splendour of their colours, or the innumerable benefits which, through the foresight of Providence, they confer upon the human race. We therefore deem it incumbent upon us to exhibit an ample view of the present condition of Systematic Ichthyology; but before doing so, we shall endeavour to add to the interest of the subject by a few general observations.

We may state, in the first place, that we here intentionally refrain from any bibliographical inquiry, or historical exposition of the progress of Ichthyology. If such were complete, or even ample, it would occupy too much of that space which we deem more usefully devoted to the actual condition of our subject-matter. We more willingly set that department aside, when we consider how perfectly it has been presented by Baron Cuvier.² We shall, however, briefly allude to what may be regarded as the principal epocha in the progress of Ichthyological Science. During many remote ages it consisted, in common with all the kindred branches of human knowledge, of nothing more than a few partial and disjointed observations. Aristotle, about 350 years before the Christian era, made some progress towards connecting these together as a body of doctrine; but still it was a feeble body, reposing upon truths (perceived indeed with surprising skill when we consider the scanty data) as yet obscurely known and vaguely expressed, owing to the entire absence of all proper standards for the distinction of species. For more than eighteen hundred years ensuing, those who wrote on natural history can scarcely be regarded in any other light than as either copiers or commentators of Aristotle; but about the middle of the sixteenth century, Belon, Rondelet, and Salviani, the true founders of modern Ichthyology, made their appearance (we mean as authors), by a singular coincidence, almost precisely at the same time,—the first in 1553, the second from 1554 to 1555, and the third from 1554 to 1558. Differing from their compiling predecessors, they

Introduc-
tion.

¹ From *ἰχθύς*, a fish, and *λόγος*, a discourse.

² See the *Tableau Historique des Progrès de l'Ichthyologie, depuis son origine jusqu'à nos jours*, in the first volume of his great though unfortunately uncompleted work, the *Histoire Naturelle des Poissons*. We deem ourselves fortunate beyond our predecessors in encyclopædic labour, in having as a guide in so difficult a subject as that on which the reader is about to enter, the first nine volumes of Baron Cuvier's signal publication. We should act unwisely were we to present a crude compendium of the works of foreign and British writers, such as has hitherto sufficed for publications similar to that in which we are now engaged. We prefer adhering throughout to Cuvier's system of arrangement, as one which, without doubt, is entitled to supersede all others hitherto proposed. We shall also avail ourselves, wherever our doing so seems likely to instruct the reader, of whatever general or miscellaneous information is scattered through his work, presenting it in a form and sequence the most advantageous to those unacquainted with the voluminous original; and adding, especially in relation to our native species, whatever we find of interest in recent authors, among whom, as elucidators of “British Fishes,” Messrs Couch and Yarrell stand pre-eminent. We beg to make this general acknowledgment of the infinite advantage we have derived from Baron Cuvier's labours, in the formation of the present treatise, in reference both to our introductory and systematic portions.

Introduc-
tion.

saw and examined for themselves, and made drawings from nature, if not with the elegant accuracy of modern days, at least with a recognisable exactness. Yet, true to the genius of their time, they continued to attach much more importance to the ascertainment of the names which the species bore in the classical pages of antiquity, than to the composition of their history, as it were afresh, by the light of nature and their own knowledge. Nevertheless they rectified as well as extended the observations of Aristotle, and laid a positive base or new foundation of the subject, by figures and descriptions of a certain number of well-determined species. About the close of the seventeenth century, Willughby, and his illustrious friend John Ray, gave for the first time a history of fishes, in which the species were not only clearly described from nature, but distributed in accordance with characters drawn solely from their structure, and in which we are no longer unnecessarily burdened with inapplicable passages from either Greek or Roman writers. Finally, about the middle of the eighteenth century, Artedi and Linnaeus completed what the others had commenced, by establishing well-defined generic groups, consisting of ascertained species precisely characterised. From that period it may be said that no radical defect existed, nor any obstacle in the way of a gradual perfecting of the system, which could not be overcome by zeal, accuracy, and perseverance. Nevertheless it is to the genius of Baron Cuvier that we owe the gigantic stride which has been made in our own more immediate days. Prior to 1815, the methods of almost all the modern systematic writers were little else than modifications, variously disguised, of the Linnæan system,—that is, with alterations, generally for the worse, of the nomenclature of the illustrious Swede. They darkened knowledge by a multiplicity of vain words;—and when any principle of classification was brought forward,—if new, then it was untrue to nature,—if true to that beautiful abstraction, then it was already familiar as household words. But forty years assiduously devoted to Ichthyology,—that is, to a deep study of all preceding authors, to a constant ascertainment of whatever could be gathered of the habits of fishes, and to the formation of an unrivalled museum of comparative anatomy, where both their outward and internal forms were perfectly displayed,—convinced the great French naturalist that many heterogeneous groups still formed portions of our ichthyological system, and that a salutary reformation might consequently be effected in numerous minor details.

It was obvious, from an attentive consideration of the subject, that the differences of both external and interior organs, by which fishes might be distinctly characterised, were not less numerous than decided; and, that in truth there were few classes of created beings among which it was more easy to recognise the existence of natural groups. But with a view to dispose of the genera and families in a becoming order, it was necessary to seize upon a small number of important characters, from which might result certain great divisions, not likely to break up natural relations, and yet sufficiently precise and perceptible to leave no doubt as to the place of each species. This was a principal desideratum, and one which the industry and perseverance, not less than the genius and high attainments, of Cuvier, have gone so far to satisfy.

The numerous characters held in common by the chondropterygian or cartilaginous fishes were too remarkable to have escaped detection by those who loved and sought for the light of system. Thus all Ichthyologists have agreed in the formation for these fishes of a separate order; but

the Baron has observed, that almost all have likewise injured the justness of their ordinal division, by a combination of certain species which resembled the true cartilaginous kinds merely in the softness of their skeleton. Thus the genera *Lophius* and *Cyclopterus*, except in that softness, do not differ in any respect from the ordinary osseous fishes, and therefore ought not to be withdrawn from them. But there are others which, in addition to the softness of their bones, present peculiar characters in their tegumentary system, in their teeth, and especially in the disposition of the skeleton of the head, which render their immediate union with either of the great groups of osseous or cartilaginous fishes a matter of greater doubt and difficulty. Such, for example, are the genera *Tetodon*, *Diodon*, *Ostracion*, and *Balistes*. The *Syngnathi*, or pipe-fish, likewise present, in their peculiar branchiæ, distinctive characters of great importance. The remarkable external aspect of these different genera had long induced the majority of naturalists to separate them from the others; but it so happened also that the same majority were by no means fortunate in discovering the true characters of separation. Thus Artedi not only re-united them to the *Lophii* and lump-fish, in the order of branchiostegous fishes, but he established that entire order on a false supposition—to wit, that they possessed no rays in their branchial membrane (“*branchiis osseis, ossibus destitutis*,”—“*branchiostegi in branchiis nulla ossicula gerunt*,”¹)—while the fact is, that they all possess those rays, and that even Artedi himself has inadvertently described both their nature and their number (*membrana branchiostega ossicula sex gracilia continet*) in his notice of the lump-fish (*Cyclopterus*) in question.²

Linnaeus,³ after placing the chondropterygian fishes among the reptiles, and adding thereto the genus *Lophius*; after referring the *Mormyri* and *Syngnathi* to the branchiostegous fishes of Artedi, and assigning to them the character of wanting not only the rays of the branchiæ, but the opercula (the contrary in several species being obvious to the most simple observation); afterwards combined⁴ the Chondropterygii and Branchiostegi into a single order of *reptiles* (*Amphibia Nantes*), on the supposed but quite erroneous basis of their being possessed at once of lungs and gills. Gmelin re-established the two orders of Artedi, but still attributing to the Branchiostegi the absence of rays. Gouan characterised them merely by the incompleteness of their branchiæ,—a vague expression, and indeed contestable in almost all the genera. Pennant combined them with the Chondropterygii, under the common name of *Cartilaginous*, a term adopted by M. Lacépède; but which Cuvier has shown, in relation to the actual contents of the group, to be improper. The great French anatomist has observed that the appellation is by no means applicable, either in a positive or a negative sense. It cannot in any way be maintained that the skeleton of the *Balistes* is cartilaginous; and among the number of species which Pennant and his followers leave among the osseous fishes, there are several, for example, the *Leptocephali*, in which we can scarcely perceive the vestige of a skeleton.⁵

Baron Cuvier's great object thus became, to disentangle, as it were, those anomalous groups, or at least to separate all such as seemed to differ sufficiently from the type of ordinary fishes to authorize such separation. His next object was the discovery of precise characters, capable of being clearly expressed in words. This examination soon convinced him that such genera as *Lophius*, *Cyclopterus*, *Centriscus*, *Mormyrus*, and *Macrorhynchus*, had been erroneously withdrawn from the great group of ordinary

Introduc-
tion.

¹ *Genera Piscium*, p. 85.

² *Ibid.* p. 62.

³ *Systema Naturæ*, 10th ed.

⁴ *Systema Naturæ*, 12th ed.

⁵ *Hist. Nat. des Poissons*, t. i. p. 555.

Introduction. fishes, from which in fact they essentially differed in nothing. But he satisfied himself that the singular genus *Syngnathus*, of which the form and economy are so remarkable, were distinctively characterised by their branchiæ, in the form of tufts (hence the title of *lophobranchial* fishes), concealed beneath an opercle which permits the water to escape only by a small opening towards the nape of the neck; and that the genera *Diodon*, *Tetrodon*, *Ostracion*, and *Balistes*, independently of the singularity of their general form, and the incompleteness of their skeleton, have the jaws, and in general all the bones of the head, somewhat differently arranged from the corresponding parts in the generality of fishes, the upper jaw and the palatine bones being articulated with each other, and with the vomer, by immoveable sutures—a structure which leaves them much less freedom in the opening of their mouths, and is also the cause (in connection with the tightness of the tegumentary envelope which fastens down the branchial apparatus) of so many naturalists having failed to perceive that the genera in question were furnished with rays and opercula like other species.

But these groups once separated, there remained nine tenths of the whole class of fishes, among which the first great distinctive division which presents itself is, into such as have soft fins, or of which the rays are branched and articulated, and into such as have spiny fins, of which a portion of the rays consist of pointed bones without branches or articulation,—two primary divisions, corresponding to the great groups named respectively MALACOPTERYGII and ACANTHOPTERYGII by Artedi. Even this principle of classification is not universally prevalent; for, in its practical application, we are obliged to keep out of view the first rays of the dorsal and pectoral fins in certain species of the genera *Cyprinus* and *Silurus*, in which these rays exhibit strong and solid spines, although we still class them with the Malacopterygii, or soft-finned division.¹ In like manner, there are, among the other great division, corresponding exceptions to the acanthopterygian character, as in the blennies and certain Labridæ, of which the spines are so small, so feeble, or so few in number, as almost to escape detection. However, if the principle referred to is not quite precise in relation to these slight anomalies, it is on the whole well founded, and certainly does not force us to separate numerous species which nature has approximated.

The same cannot be asserted of those distinctions which naturalists have sought to establish on other principles, nor of those on which so many of the secondary divisions have been founded. Thus the general form of the body, and the absence of the ventral fins, the characters assumed by Ray, anterior to those deduced from the spines, force a heterogeneous grouping of the eels, the gobies, the Syngnathi, the Xiphias, and the moon-fish. Linnæus was the first (in the tenth edition of the *Systema Naturæ*), while neglecting the distinction of the spiny rays, to imagine the division of ordinary fishes into *apodal*, *jugular*, *thoracic*, and *abdominal*, according to the absence or position of the ventral fins; and in so doing obliged himself to place the genera *Xiphias*, *Trichiurus*, and *Stromateus* with the eels and *Gymnoti*, the *Gadi* between the weevers and the blennies, *Pleuronectes* between *Zeus* and *Chatodon*, and the *Amphacanthi* as intermediate with *Silurus* and *Loricaria*. Va-

rious modifications have since been proposed of the Linnean arrangement, but our present limits will not admit of our entering upon these as exhibited in the various works of Gouan, Lacepède, Dumeril, Risso, Rafinesque, Goldfuss, Oken, and others who have laboured to amend the modern system.²

SECT. II.—THE EXTERNAL FORM AND CHARACTER OF FISHES.³

The form and structure of fishes are as admirably adapted for rapid movement through the water, as are those of birds for that aerial motion called flight. Suspended in a liquid element of almost equal specific gravity with themselves, external organs resembling those of birds in size would have been disproportioned and unnecessary; but the air-bladder (the functions of which, by no means entirely understood, have never been satisfactorily explained in all their bearings) is known to possess the power of contraction and dilatation, the exercise of which is followed by a corresponding descent or ascent of the animal's body. Thus a small, central, and inconspicuous organ effects, in the easiest and most simple manner, the same object which even the soaring eagle or giant condor can only attain by great exertion of the wings, and after laborious and frequently repeated gyrations. We shall ere long, however, have occasion to observe, that the air-bladder, although essential to the economy of such species as possess it, is by no means indispensable to the class of fishes, as in many tribes it is entirely wanting.

Fishes being without a neck, and the part called the tail for the most part equalling at its origin the portion of the trunk from which it springs, the prevailing shape is somewhat uniform, diminishing gradually towards either end. Doubtless, however, a vast variety of form is exhibited in a class which is now calculated to contain from six to eight thousand collected species. Of these forms a sufficiently accurate idea may be acquired by inspecting the numerous plates which accompany the present treatise, and we shall therefore not attempt any further verbal illustration of the subject, although we shall add a few notices regarding the general aspect and character of the principal external parts.

The mouth of fishes either opens from beneath, as in the rays, or at the extremity of the muzzle, as in the majority of the class, or from the upper surface, as in *Uranoscopus*. It also varies greatly in its relative dimensions, from the minute perforation of *Centriscus*, to the vast expansion of the angler fish.

Exteriorly only two of the organs of the senses are visible, the orifices of the nostrils and the eyes. The former may be simple, as in the rays and sharks, or double, as in the generality of osseous fishes; and they differ in their position in relation to the jaws, the eyes, or the extremity of the muzzle. The eyes vary extremely in respect to size in the different species, and even sometimes disappear entirely beneath the skin; and they also differ greatly in their position, being usually placed laterally, one on each side of the head, although in *Uranoscopus* (as the name implies) they look upwards, and in most of the flat fishes they both occupy the same side.

In regard to those important organs, the branchiæ or gills, a single family alone, the chondropterygian fishes,

¹ These spines, however, as Cuvier remarks, are formed, in the two genera above named, by the agglutination of a multitude of smaller parts, of which the articulations, though not obvious, are perceptible.

² For critical notices of their works, see the 1st volume of the *Hist. Nat. des Poissons*.

³ We may here premise, that in the ensuing sections several interesting and important particulars in the structure and physiology of fishes are very slightly, or even not at all, touched upon, in consequence of their having been already detailed in the article COMPARATIVE ANATOMY of this work. (See vol. iii. p. 1, &c.) We deemed it more advisable that the reader should be made to incur the slight inconvenience of referring occasionally to a separate treatise, than that the present publication should be burdened by a repetition of the same subject.

Introduc-
tion.

are characterised by having their exterior margin fixed to the skin, with as many openings for the issue of the water as there are intervals between the branchiæ themselves; but all other fishes have the external margin of the branchiæ free, and the water which enters the mouth escapes by the opening of the gill-covers.

A certain number of the fins are vertical, and serve the fish somewhat in the same way as a vessel is served by her helm and keel. Of these, some, called *dorsal*, are attached to the back, others, beneath the tail, are named *anal*, while a fine expansion, which usually terminates the body, is known as the *caudal* fin. All these are *vertical* fins, and vary in different tribes, either in number, or dimensions, or the nature of the rays by which they are supported, and which are sometimes spiny, sometimes branched and composed of numerous articulations. The other fins are disposed in pairs, and represent the four external members of the higher classes, such as quadrupeds and birds. Those which correspond to the fore-legs of quadrupeds and the wings of birds are named the *pectoral* fins, and are always attached behind the gills; those again which are regarded as the analogues of the hinder extremities of the other classes are named the *ventral* fins, and have a considerable range of position in different species, from as far forward as beneath the throat, to the origin of the tail. Like the vertical fins, they also vary in size, and in the number and structure of their rays; and one or even both pairs are occasionally wanting, as in eels, which have no ventral fins, and Murenæ, which have neither ventral nor pectoral fins. Indeed the *Apterichti* have no fins at all.

Those fishes are named MALACOPTERYGIAN, of which all the rays of the fins are articulated, and of a softer structure: while such as are characterised by having at least a portion of their rays hard, simple, and in the form of spines, are included under the general title of ACANTHOPTERYGIAN fishes.¹ These great divisions apply solely to the osseous species. We have already mentioned that the cartilaginous kinds are distinguished by the name of CHONDROPTERYGIAN, while two lesser groups, in some respects intermediate between these and the preceding, fall under the orders LOPHOBRANCHII and PLECTOGNATHI of Baron Cuvier.

The differences hitherto alluded to are connected with intimate structure—with the skeleton or bony frame-work of the fish. There are of course others of a slighter or more superficial character. The jaws may be armed with teeth of all sorts, and these weapons sometimes occupy all parts of the mouth, and are found occasionally even in the throat. The lips are frequently furnished with a kind of fleshy beard or barbles, which differ greatly in number, size, and substance. Some have long fleshy isolated filaments hanging to the body, as in *Scorpana*; and occasionally one or more of the rays is to a certain extent detachable from the fin, and susceptible of independent movement.

The nature of the surface or external tegument of fishes also varies greatly. Some may be called naked, while others are scaly, spinous, or plated, in whole or in part. If to these considerations we add the infinitely varied character of colour in all its admirable distributions, and the differences in size and weight observable in fishes, we shall be able to form a general idea of the external aspect of this great and important class.

SECT. III.—THE OSTEOLOGY OF FISHES.

In regard to the texture of the bones of fishes, their skeletons are either *bony*, *fibro-cartilaginous*, or *truly car-*

tilaginous. Those distinguished by the last-named character are the chondropterygian groups, such as the sturgeons, sharks, and rays, all of which exhibit throughout the whole of their frame-work, in their branchiæ (the external border of which is fixed to the skin, and through which the water is allowed to escape only by narrow openings), and in other important parts of their organization, distinctive characters, which obviously separate them from all other fishes. They are in fact destitute of true bones, their harder parts consisting only of a homogeneous and semitransparent cartilage, which is merely covered on the surface in certain genera by a layer of small, opaque, calcareous granules, closely set together. In the lampreys even this envelope is wanting, while among the *Ammocetes* the skeleton continues in an actually membranous condition. The sturgeons and Chimæræ partake in some measure of the lamprey character in relation to the softness of their spines, but the first-named genus is possessed of many true bones of the head and shoulder.

Other fishes differ in their osteological character chiefly in the hardness of their skeleton, and it is without reason that the fibro-cartilaginous kinds have been associated by some authors with the Chondropterygii. The calcareous matter, that is, the phosphate of lime, is deposited in layers and fibres in the cartilage which forms the basis of their bones, precisely in the same manner as among the hard-boned species, but less abundantly; and the texture of the bone never becomes so hard and homogeneous as among the osseous kinds. Thus in *Tetrodon Mola* we perceive, as it were, only scattered fibres amid the membranes, and in *Lophius piscatorius* they are nearly as soft. The other Tetrodons and Diodons, the Balistes and the Ostracions, have denser bones; and in some species these parts can scarcely be distinguished from those of the osseous fishes. It is certain also that the bony frame-work of the fibro-cartilaginous kinds is constructed on the same plan as that of the truly osseous species, and not in accordance with those of the Chondropterygii; and it is in opposition to the known truth of nature that both Artedi and Linnæus have denied them the possession of opercula and branchiostegous rays. The *Balistes* have even ribs,—their only osteological difference consisting in the granulation of their jaws; while the *Syngnathi* have regular bony jaws, although they want the ribs and branchiostegous rays.

The majority of osseous fishes have bones fully harder than those of other animals, and it is quite a gratuitous assumption to suppose that the observed longevity of certain species arises from the softer consistence of those parts. Certain fish bones, in fact, exhibit neither pores nor fibres, and appear almost vitreous to the eye. But neither the osseous nor the cartilaginous kinds have either epiphyses to the bones, or medullary canal within them; but there are some, such as the trouts, in which the tissue of the bones is more or less penetrated by an oily juice; while in others, such as the Dory, the internal portion continues cartilaginous, while the surface is completely ossified. Finally, in certain species, while the general skeleton is very hard, particular portions of it are cartilaginous. Such are the bones which constitute the head of the pike.

When viewed in relation to their general structure, the bones of fishes, like those of other vertebrated animals, are composed of an organic base penetrated by earthy matter. The latter consists of phosphate of lime and of magnesia, with oxide of iron, supposed to be united to phosphoric acid. There is also a certain portion

Introduc-
tion.

¹ It may be here noted, however, that certain malacopterygian kinds, such as carps and siluri, have the articulations of some of the rays soldered together, in such a manner as to appear simply spinous.

Introduction. of subcarbonate of lime. The animal matter is of two kinds:—the one, of an azotised nature, forms the base of the cartilage; the other is fatty, in the form of a pervading oil. The cartilage of fish bones differs from that of mammiferæ and birds, in as far as it yields no gelatine when subjected to the process of boiling. The oil is composed chiefly of oleine, impregnated with an odorous principle and a yellow colouring matter. The oil itself is easily convertible into soap, and then produces oleic acid, glycerine, and a minute portion of margaric acid.

The skeleton of osseous fishes consists of the head; of the respiratory apparatus, having always a large bony development; of the trunk, including body and tail; and of members, that is, the pectoral and ventral fins. The vertical fins, viz. those of the back, anus, and tail, may likewise be viewed as belonging to the trunk.

The head, possessing many more moveable parts than that of the Mammalia, is subdivisible into a great many regions, such as the cranium, the maxillæ, the bones beneath the cranium and behind the jaws, and which aid in their movement and suspension; the bones of the opercles, which open and shut the overtures of the branchiæ; the bones, almost exterior, which surround the nostrils, the eye, and the temples, or which cover a portion of the cheek.

In the majority of fishes the inter-maxillary bone forms the edge of the upper jaw, and has behind it the maxillary, commonly called the mystax, or labial bone. A palatine arch, composed of the palatine, of the two pterygoid processes, of the jugal, tympanic, and squamous bones, constitutes, as among birds and snakes, a kind of interior jaw, and provides posteriorly an articulation to the lower jaw, which has usually two bones on each side. In the *Chondropterygii*, however, these various pieces are greatly reduced in number.

Besides the apparatus of the branchial arches, the hyoid bone carries on each side certain rays which support the branchial membrane; a kind of lid or clapper, composed of three bony pieces, the opercle, the sub-opercle, and the inter-opercle, unites with that membrane to close the great opening of the gills; it articulates with the *os tympani*, and plays on the piece called the pre-opercle. But, like the parts before mentioned, this apparatus is likewise wanting in many of the *Chondropterygii*.

The trunk is composed of the vertebræ of the back and tail (for we can scarcely say that there is any neck, and the sacrum is wanting); of ribs; of the interspinal bones, which give support to the dorsal and anal fins; and of the rays of those fins, and of the caudal. These rays, whether branched and articulated, or simply spinous, may be always divided lengthways into halves.

The vertebræ of fishes are characterised by the conical hollow on each of their faces. Double hollow cones are thus formed in the interval between two vertebræ, filled by a soft membranous and gelatinous substance, which passes from one void to another by means of an opening through each vertebra, and forms as it were a gelatinous chaplet through the whole. They have, as in other animals, an annular portion in their superior part, for the passage of the spinal marrow.

Fish rarely possess a sternum properly so called, and when it does exist, it is formed of almost external pieces, which unite the inferior extremities of the ribs.

Introduction. The anterior members, commonly called the pectoral fins, consist of the shoulder, an osseous semicircle composed of several bones suspended above from the cranium or the spine, and joined beneath to the corresponding portion of the other side. We can here also distinguish certain bones analogous to the two pieces of the omoplate of reptiles, to the humerus, and to the bones of the forearm; and further back there is usually a small projection, composed of two pieces, which have been supposed to represent the coracoid bone, and even the clavicle. What is more assured is, that the two bones which Cuvier compares to the cubitus and radius, bear on their margin a range of little bones, which seem to represent those of the carpus, and which themselves support the rays of the pectoral fin, excepting the first of the latter, which articulates directly with the radial bone.

The posterior members, much more variable in their position than the corresponding limbs of the Mammalia, and of which the external and moveable portions are named the ventral fins, project sometimes in advance of, sometimes beneath, and sometimes behind, the anterior or pectoral members. They are composed of four bones, of which the largest, which are likewise the most constant, being always placed in advance of the anus and of the generative system, may be regarded as a sort of pubis, and bear upon a portion of their posterior margin the rays of the fin, without any smaller intermediate bones which can be compared either to the femur, the tibia, the peroneum, or tarsal bones. The rays of both the pectoral and ventral fins are likewise divisible lengthwise into halves, like those of the vertical fins before mentioned. These rays, with the exception of the external ventral one of the *Acanthopterygii* (which is spinous), are almost always articulated.

The skeleton of the *Chondropterygii*, such as sharks and skates, is composed of pieces consisting of no fibrous tissue characteristic of bone. The interior continues in a cartilaginous state, and the surface alone becomes indurated by the accumulation of small calcareous granules, which produce externally a *stippled* aspect. The form of the cranium is similar to that of other fishes, but nevertheless consists of only one enclosure, without sutures. The face is very simple, with only two bones in the palato-temporal arch;—the first descending from the cranium, at the articulation of the jaws,—the other representing the upper jaw, and bearing the teeth. The maxillary and inter-maxillary bones are merely rudimentary. The under jaw has also but one bone (the articular) on each side, bearing the teeth; of the others only a single vestige is discoverable, concealed beneath the skin of the lip. The opercular apparatus is wanting, but the hyoidæan and branchial structure is very conformable with the same parts in osseous fishes. Sharks have, moreover, opposite to the external attachment of each branchia, a slender bone, which may be regarded as the genuine vestige of a rib. The branchial system is situate further back than in osseous fishes, and hence the humeral girdle is also more posterior. The spinal ribs, if they exist, are usually very small, except in the sturgeons. In that genus, indeed, the branchial system is in some respects intermediate between the cartilaginous and osseous fishes. Several bones of the head and shoulder are as hard as stone, yet the spine is almost as soft as that of lampreys.¹

¹ For the sake of a more explicit comprehension of the principal portions of the osteological system of fishes, we have figured (from Cuvier) the skeleton of the perch. We shall here subjoin the names of the bones, in reference to the engraved numerals. See Plate CCXC VII. figs. 1, 2, 4, 5.

Cranium: Principal frontal, 1; anterior frontals, 2; ethmoidal, 3; posterior frontal, 4; basiliary, 5; sphenoid, 6; parietals, 7; inter-parietal, 8; external occipital, 9; occipital lateral, 10; great ala, or temporal ala, 11; mastoidean, 12; rupes, 13; orbitaly ala, 14; anterior sphenoid, 15; vomer, 16. *Upper jaw:* Inter-maxillary, 17; maxillary, 18. *Nasal, sub-orbitaly, and supra-temporal bones:* First sub-orbitaly, 19; chain of bones attached to the last named, and ending at the posterior frontal (these are conspicuous in *Trigla* and *Scorpena*), likewise numbered 19; nasal, 20; supra-temporals, 21. *Palatine arch, or palatino-ptyergoidean* and

The spinal column, composed of numerous articulations united by cartilages which permit of certain movements, curves with great facility from side to side; but the vertical motion is much more restricted, chiefly in

The great organ of movement in all fishes is the tail. The muscles by which it is brought into play extend in lengthened masses on either side of the vertebral column. The body being supported chiefly by the swimming bladder (which, however, is absent in several species), is pro-

temporal system: Palatine, 22; temporal, 23; transverse bone, 24; internal apterygoidean, 25; jugal, 26; tympanal, 27. *Opercular bones*: Operculum, 28; styloid, 29; pre-operculum, 30; symplectic, 31; sub-operculum, 32; inter-operculum, 33; this last-named bone furnishes an attachment to the branch of the hyoid bone at the point where it is itself joined to the styloid, which suspends it on the temporal bone, and hence the opercular shutters can neither open nor close without a corresponding movement of the hyoidean branches. *Lower jaw*: Dental, 34; articular, 35; these are the usual divisions, but there is often a third bone, the angular, 36, and sometimes a fourth, on the internal face of the articular, corresponding to the opercular of reptiles, 37. Thus the head of fishes usually consists of about sixty bones—the amount being sensibly greater in such species as have the upper maxillary subject to division.

Hyoid bone and branchiostegous rays. The three opercular pieces above mentioned do not of themselves effect the closure of those great clefts observable on each side of a fish, between the head and shoulder, and within which are the respiratory organ or branchiæ. This closure is completed by the *branchiostegous membrane*, which adheres to the hyoid bone. (See Plate CCXCVII. figs. 2, 4, and 5.) This bone is placed as in other vertebrated classes, but is always suspended to the temporal bones. It is composed of two branches, each consisting of five pieces, viz. the styloid, 29, by which it is suspended to the temporal; two large lateral pieces, 37 and 38, placed one behind the other, and forming the principal portion of the branch (the posterior, 38, being that which attaches to the inter-operculum); lastly, two small pieces, 39 and 40, placed one above the other at the anterior extremity of the branch, and serving to unite it with the corresponding portion of the other side. Anterior to this junction is the lingual bone, 41, and behind it, in the angle formed by the meeting of the two branches, and beneath the branchiæ, is a single piece, usually vertical, 42 (fig. 5), which represents the tail of the hyoid bone, so well known in birds and lizards. It is this piece which, uniting with the symphyses of the humerals, forms what is called the *isthmus*, which separates the two branchial openings from below. Thus in its totality the hyoid bone of fishes is composed of twelve bones.

The *rays*, 43, which support the branchiostegous membrane, adhere by moveable articulation, or by simple ligaments, to the inferior margin of the principal portions already mentioned (37, 38) of the hyoid bone. They vary in form and number, some species having three, others thirty. The perch, which forms the subject of our illustration, has seven branchial rays; and that number is the most common among the acanthopterygian fishes.

Bones which support the branchiæ. As fishes cannot respire except by making the water which they have taken into the mouth flow out by the openings behind the lateral part of the head, it thus passes between the branchiæ, those well-known comb-like organs, usually four in number on each side, composed of a great quantity of thin, narrow, forked laminae, of a membranous or cartilaginous nature, and placed in files. These four pair of branchiæ are supported by four pair of arches, adhering by their inferior extremities to the two sides of a chain of small intermediate bones, which is itself attached to the angle formed by the anterior portions of the hyoid bone, and above the tail of the latter. These arches ascend in a curve, and are attached at their other extremity beneath the cranium, but by means only of cellulosity, or of ligaments. The intermediate chain of bones just alluded to forms, in a certain sense, a continuation of the lingual bone. There are usually three: the first, 53 (see chiefly fig. 4), is attached at the base of the angle formed by the two branches of the hyoid bone; the second, 54, affords attachment to the first pair of arches; and the third, 55, affords the like attachment to the second pair, while the third pair adheres to its extremity; the fourth pair of arches is connected with the angle of the third pair. Each arch is composed of two parts, moveable on each other, and the inferior portion of the first three pair itself consists of two pieces, 57 and 58; in the last pair there is only a single piece, 60. The upper portion of the arches, 61, is simple, except in the first pair, which is usually suspended from the cranium by a small stylus, 59. The inner face of these arches is furnished with small plates or cones of osseous lamina, usually armed with teeth variously disposed according to the species. The most general uses of this armature are to arrest the progress of such substances as the fish is swallowing,—to prevent their escaping with the respired water, or their producing inconvenience amid the interstices of the branchiæ. It may be likened in its functions to the epiglottis of quadrupeds, or the dentations of the margins of the larynx of birds. Besides the interior range of conical plates, the perch possesses an external row of slender pointed teeth, resembling those of a garden rake, upon its first pair of arches, see 63.

Pharyngeal bones. At the entrance to the œsophagus, and immediately below the branchial apparatus, are placed the pharyngeal bones, which produce a second mastication, often more powerful than the first; for this purpose they are armed with teeth of very variable form and number, according to the species. These bones are usually two inferior, 56, and six superior, 62.

Vertebræ. We have already described the general character of the vertebral bones of fishes. Their special forms will be best understood by an inspection of Plate CCXCVII. fig. 1, Nos. 67, 68, 69, with the processes, marked *a*, *b*, *c*. The ribs are shown at 72; the styles or appendages which frequently adhere to those parts, at 73. In a few fishes the ribs are entirely wanting.

Vertical fins. These are supported by rays composed of an internal portion, named the interspinal, 74, which serves as a sustaining root, by penetrating the flesh among the great lateral muscles, and an external portion, which exhibits the rays *properly so called*, as seen at 75. We sometimes find an interspinal bone which bears no rays, 76. A certain number of these vertical rays are pointed bones, and are then named spines, or spiny rays; others are bony or solid only towards their base, their remainder being formed of a multitude of small articulations, and frequently ramified into lesser branches, themselves still further divided; in these states they are named articulated, soft, or branched rays. Those of the tail, 71, are always soft and articulated; although, towards the root, both above and below, 78, they gradually diminish till only the solid portion of the base remains. In a great number of fishes the vertebra at which the abdomen terminates and the caudal part begins, and even that which follows it, 83, 83, have a great inferior spinous process, to which is joined a more or less voluminous bone, 79, extending behind the anus, and thus forming the posterior boundary of the abdominal cavity.

The *sternum* does not exist in all fishes. When present, it consists of a series of single bones of various configuration, according to the genera, and at these the ribs terminate.

Bones of the shoulder and arm. In osseous fishes, we find on each side, immediately behind the orifice of the gills, a suite of bones, forming a kind of frame, on which the opercle rests when closed. These bones, usually attached to the head from above, and uniting together below, form an osseous belt, surrounding that part of the body. Their inferior symphysis unites by ligaments to the tail of the hyoid bone (formerly mentioned, 42), and forms with it the *isthmus*, which separates the external openings of the gills from each other beneath, just as the cranium separates them above. This cincture, when complete, is composed on each side of three bones, which represent the shoulder and the arm, to which adheres, posteriorly, a group of two or three others, occupying the place of the fore arm, and bearing the pectoral fin, which may be considered as the hand; lastly, there is almost always suspended a style, composed of one or two bones, which Cuvier regards as the analogue of the coracoid bone. The highest of these first three bones, 46, is usually forked, and attached by its two crests to the lateral crests of the cranium. It is visible externally at the top of the branchial opening, resembling a scale, larger than the others, and is sometimes toothed on its edges. The second, 47, continues along the margin of the branchial opening. The third, 48, always the largest, completes the cincture, by uniting with its counterpart beneath the throat. To the inner surface of the last-mentioned bone adheres a fourth, 51, and fifth, 52, placed one above the other. The free side of these bones bears the pectoral fin, but by means of an intermediate range of four or five small bones, 53. These bonelets may be supposed to represent the carpal series; and if so, then the two others, 51 and 52, will be the cubitus and radius. The third

Introduction. pelled forwards by the rapid flexure of the extremity acting laterally upon the resistance offered by the water. Generally speaking, neither the pectoral nor the ventral fins are of any material use during swift progressive motion; they rather serve to balance the body, or to aid its gentler movements while in a state of comparative repose. In *flying fishes*, as they are called, the pectoral fins are of such great length and expansion as to support the animal in the air; and the strength of muscular action might probably suffice even for a longer flight, but for the necessity of constant moisture for the purposes of respiration. The drying of the gills in an individual of this class is attended by results analogous to those produced by submersion in the case of a land animal;—and a flying fish is obliged to descend to respire, in like manner as a swimming quadruped, or disguised mammiferous animal (as we may term a whale), is under the necessity of ascending for the same purpose.

The head of fishes exercises but a slight movement independent of the rest of the body; but the jaws, hyoid bone, palato-temporal and branchial arches, and pharyngeal and opercular bones, are very free in their motions. The muscles of fishes, like those of other vertebrated animals, are composed of fleshy fibres more or less coloured, and of tendinous fibres of a white or silvery colour. With the exception, however, of certain special muscles which are sometimes of a deep red, the flesh of fishes is much paler than that of quadrupeds, and still more so than that of birds. In some species it is even entirely white.

SECT. V.—THE NERVOUS SYSTEM AND SENSES OF FISHES.

The sensitive system of fishes, like that of the higher classes, is composed of the external senses, of a central medullary apparatus, and of nerves of communication. As in the classes alluded to, the central portion of the nervous system, that is, the brain and spinal marrow, occupies the cavity of the cranium and vertebral column.

As fishes respire through the intervention of water alone, that is, as they can scarcely avail themselves, in rendering their blood *arterial*, of any thing more than the small portion of oxygen contained in the air which is suspended in the water, their blood is necessarily cold, and their general energy, and the activity of their senses and movements, are less than among Mammalia and birds. Their brain also, though of similar composition, is proportionally much smaller; and the external organs of the senses do not seem of such a nature as to be capable of impressing or conveying towards it any vivid excitement. Indeed the most striking characteristic of the brain of fishes is its extreme smallness, when compared either with the total size of the body, with the mass of nerves which proceed from it, or with the cavity of the cranium in which it is contained. In the burbot, or *Gadus lota*, the weight of the brain to

Introduction. that of the spinal marrow is estimated by Carus to be as 8 to 12, and to that of the whole body as 1 to 720. It was previously known that the brain of the pike weighed in proportion to that of the whole body as 1 to 1305. Now, in many small birds, the brain, viewed in relation to the rest of the body, is equal to a twentieth part. In the generality of fishes, the spinal marrow extends along the whole of the caudal vertebræ; and it is thus that it preponderates over the brain. The *Lophius piscatorius*, however, and a few other species, form remarkable exceptions to this rule, as in them the spinal marrow disappears before it reaches the eighth vertebra; but in the greater proportion of cases it may be said that the spinal cord in this class terminates by a single thread in the last caudal vertebra.¹ The brain of fishes by no means fills up the cavity of the cranium; and the interval between the pia-mater which envelopes the brain itself, and the dura-mater, which lines the interior of the skull, is occupied only by a loose cellulosity, frequently impregnated by an oil, or sometimes, as in the sturgeon and thunny, by a rather compact grease. It has also been remarked, that this void between the cranium and the brain is much less in young subjects than in adults; from which it may be inferred, that the brain does not increase in an equal proportion with the rest of the body. Cuvier, in fact, has found its dimensions nearly the same in different individuals, of which the general size of the one was double that of the other.

When compared with that of quadrupeds, the brain of fishes has been said to possess an embryonic character, and to have its greatest development in the cerebellum, the seat of the appetites. Of all vertebrated animals, fish in fact exhibit the smallest apparent signs of sensibility. Having no elastic air to act upon, they are necessarily mute, or nearly so; and all the sensations which the delightful faculty of voice has called into being among the higher tribes, are to them unknown. Their glazed immoveable eyes, their fixed and bony faces, their bodies and members moving altogether, if they move at all, admit of little play in their physiognomy, and of scarcely any expression to their emotions. Their ears, surrounded on every side by the bones of the cranium, destitute of external conch, without any internal cochlea, and composed merely of some sacks and membranous canals, scarcely suffice for the perception of the loudest sounds. Even their sight may be supposed to find but little exercise in those profound depths where so many of the inhabitants of ocean dwell, although the largeness of the visual organs in many species probably in some measure makes amends for this deficiency of light. But even in those species the eye cannot change its direction; still less can it alter its focus, so as to accommodate the vision to a varying distance; for the iris neither dilates nor contracts, and the pupil remains for ever the same in all degrees of light. No tear moistens its glazed surface, no eyelid clears or protects it, and it

bone of the cincture, which supports the two last named, will then necessarily represent the humerus, and the first and second (46–7) the shoulder blade. There still remains to be mentioned a species of style, almost always composed of two pieces, 49 and 50.

Carpal bones. At the outer edge of the radial and cubital bones adhere the small flat bones, 53, compared to the carpus. Their function is to support the rays of the pectoral fin, 53, *a*, however numerous these may be, with the exception of the first, which articulates directly with the radius or upper bone, 52.

Bones of the hinder extremity. The os innominata, the thigh, the tibia, and the tarsus, are represented in fishes by a single bone, 80, usually of a triangular form, but more or less complicated by processes and projecting plates. Its posterior side affords attachment to the rays of the ventral fins. In eels and others, in which the ventral fins are wanting, the bone is also absent.

The rays of the extremities. These rays, that is, those of the pectoral and ventral fins, 82 and 53, *a*, without being as symmetrical as those of the vertical fins, are equally divisible into halves. Except the external ray of the ventral in the Acanthopterygii, 81, they are almost always articulated, but their bases become solid, and there the articulation is scarcely if at all perceptible.

¹ In regard to the shortness of the spinal cord in *Lophius*, the fact, as above referred to, is taken from the dissertation of Apostolos-Arsaki, a Greek doctor, who published *De piscium cerebro et medulla spinali*, Halle, 1813; but in a note to the *Hist. Nat. des Poissons* of Cuvier (vol. i. p. 437), we find the following correction of that statement:—"Sa moelle règne presque tout le long de l'épine; mais elle est enveloppée et cachée par les nerfs, qui naissent beaucoup plus haut qu'ils ne sortent." It is certain, however, from Cuvier's recent statement, that the supposed character is truly exhibited by the *moon-fish* (*Lampris guttatus*, Retz; *opah* of Pennant), "Où la moelle épinière est tellement raccourcie qu'elle ne semble qu'une petite proéminence conique de l'encéphale, de laquelle les différentes paires de nerfs partent comme une queue de cheval." (*Ibid.*)

Introduc-
tion.

consequently offers but a dull and feeble representative of that beautiful and most expressive organ, so full of life and animation in the higher tribes.

The position, direction, and dimensions of the eyes of fishes vary greatly. In some they have an upward aspect, and are often very close upon each other; in others they are lateral, and so wide apart as to be even directed slightly downwards. But of all anomalies, one of the most extraordinary which their position presents, is that of the *Pleuronectes* (such as turbot, flounders, soles, &c.), in which the two eyes are placed, as it were, the one above the other, and both upon the same side of the head. In certain species of the eels and *Siluri*, they are so small as to be scarcely visible; while in other groups, such as *Priacanthus* and *Pomatomus*, they surpass in proportional diameter whatever is known of the same organs in the higher classes. It may be said in general that the eye of fishes is large, and that its pupil especially is broad and open; a character probably connected with the necessity of collecting whatever devious rays of light may penetrate the obscure depth of waters. Fishes have no true eyelids. The skin always passes over the eye, to which it is slightly adherent; and it is for the most part sufficiently transparent for the passage of the solar rays. In some species, such as eels, it passes over without the slightest fold or duplication; while in a few, for example, the *Gastrobranchus cæcus* of Bloch, it continues quite opaque, so as entirely to conceal the eye. In others, as the well-known mackerel and herring, it forms an adipose fold both before and behind; but these folds are fixed, and being unprovided with muscles, have no mobility. Sharks have one, somewhat more moveable, on the inferior margin of the orbit. The globe of the eye itself is very slightly moveable, although, like that of man, it is furnished with six muscles. Perhaps the most singular eye presented by the class of fishes is that of *Anableps*, which has two corneæ, separated by an opaque line, and two pupils pierced in the same iris, so that one might deem it double; but there is only one retina, and a single vitreous and crystalline humour. In accordance with the general structure of the eyes of fishes (which we shall not further detail), the nearly spherical form of the crystalline humour, the immobility of the pupil, and the difficulty with which it changes the length of its axis, we can scarcely doubt that the vision of this class is comparatively imperfect. Images must be but feebly painted in their retina, and their visual perceptions must be indistinct and dull. At the same time it is evident that they perceive their prey from a considerable distance; and the angler, who knows either how rapidly they seize or how cautiously they avoid his lure, and with what discrimination they sometimes prefer one colour or kind of artificial fly to another, must be impressed with the belief that the power of vision, at least of certain species, is by no means devoid of clearness and precision.

The organ of hearing in fishes consists of little more than the labyrinth, and that a much less complicated one than the corresponding part in either quadrupeds or birds. They have no external ear, unless we may bestow that name on a small cavity, sometimes slightly spiral, which we find in the rays. It is however always covered by the skin, and is not perceptible among the osseous fishes. A few of the latter, such as the genus *Lepidoleprus*, and certain *Mormyri*, have merely openings in the cranium closed by the skin, by means of which the vibrations of the element by which they are surrounded may be conducted to the labyrinth. In some other species, as *Myripristis*, the cranium is open beneath, and its orifice is closed by a membranous partition, to which the swimming bladder adheres; but these communications are very different from that which takes place by means of the tympanum, and still more by means of the Eustachian tube in other classes.

Both these parts, as well as the bones, are in fact wanting in the class of fishes. Those who find in the bones of the operculum the four bones of the ear of man suddenly and prodigiously developed, hazard such a notion merely on the assumption that the bony pieces are the same in number in all crania; but it must be borne in mind, that neither the form, nor the relations, nor the functions of these bones, nor their nerves nor muscles, support such a comparison. The ear of fishes, then, is much less complete than that of quadrupeds, birds, or even of the majority of reptiles. There is no doubt that they possess the sense of hearing; but it is merely a general sense of sound, and is in all probability incompetent to perceive any variety or range of intonation. In truth, the simple fact of fishes being as a class entirely mute, is of itself a logical ground for believing that their perception of sound is extremely dull.

A few lines may now be devoted to the consideration of the sense of smell. The nostrils of fishes are not so placed as to be traversed either by air or water, in connection with the act of respiration. They consist merely of two openings, situate near the extremity of the muzzle, and lined by the pituitary membrane, which is raised in extremely regular folds. In the ordinary fishes, the bones which Cuvier regards as the nasal serve as the arch or covering; while the vomer, the maxillary, and inter-maxillary contribute to sustain the sides, the first sub-orbital forming the inferior portion. The shape of the nostrils is sometimes oblong, sometimes round or oval. They are placed either at the end of the muzzle or on its sides; sometimes on its superior face, and even occasionally, as in skates and sharks, on its under surface near the angle of the mouth. In the lamprey they are approximate on the top of the head, and open by one common orifice. In the great majority of fishes, perhaps in all the osseous kinds, each nostril opens by two orifices, the one posterior to the other, and in some cases at a considerable distance. These are what are called double nostrils; an inaccurate term, in as far as each pair of holes leads only to a single cavity. The margins of the anterior orifice are often tubular, as in the eel, and sometimes a single side of the tubular margin is prolonged into a tentacular appendage, as in several *Siluri*. In the genus *Lophius* the nostrils are borne upon a little pedicle, so as somewhat to resemble mushrooms. Various other modifications are observable in different genera, although not necessary to be here narrated. It does not appear, at least in the osseous fishes, that the envelope of the nostrils possesses mobility, or that the orifices are furnished with muscles by means of which they can be opened and shut.

It is certain, however, that fishes possess the faculty of perceiving odours; that various scents attract or repel them; and there is no reason to doubt that the seat of that perception lies in the nostrils. It may be reasonably conjectured that its strength depends mainly on the degree of development produced by the number and extent of the interior folds.

In regard to the sense of taste in fishes, it is evident that as, with few exceptions, they swallow their food rapidly and without mastication, their perception of that faculty must be in noways acute. The same may be inferred from the fact of their tongue being almost immoveable, often entirely osseous, or beset with teeth or dental plates, and from its receiving very slender nerves, and these but few in number. Even those species of which the jaws are so armed as to enable them to cut and bruize their aliments, cannot long retain the latter in their mouths, on account of the position and the play of the respiratory organs. No salivary glands discharge their moisture on the organs of taste. The tongue itself is not seldom entirely wanting; and even when it exists in its most distinct and apparently fleshy state, it consists merely of a ligament-

Introduc-
tion.

Introduc-
tion.

Introduc-
tion.

ous or cellular substance, applied on front of the lingual bone. It is never furnished with muscles capable of producing any movement of extension or retraction, as in quadrupeds.

Fishes cannot be said to be more highly favoured in respect to the *organs of touch* than those of taste. The faculty is greatly deadened over the general surface by the coating of scales, and in the particular members by the inflexibility of the rays. It is chiefly confined to the lips, and even these parts in many species are themselves as hard and insensible as bone. Certain soft and delicate appendages called *barbles*, possessed by many species, such as the cod and loach, are supposed to enjoy a more delicate perception of the sense of touch. It is by means of the *dermis* that that peculiar matter, so remarkable for its silvery metallic lustre, and which bestows so much of brilliancy upon the class, is secreted beneath the scales. It is composed of small polished plates resembling burnished silver, and capable of being removed by washing, either from the skin itself, or from the inferior surface of the scales. It is this substance that is used in the formation of false pearls. It is also secreted by many species in the thickness of the peritoneum, and in the envelopes supplied by that part to particular viscera, especially the swimming bladder. The scales of the majority of fishes are *imbricated*, that is, placed partially over each other, like the tiles or slates of the roof of a house. They are not equally distributed, nor of the same form or consistence, over the general surface of the body. The head is frequently destitute of scales, and those of the lateral line of the body are distinguished from the others by one or more small tubes by which they are perforated, and by other peculiarities.¹

It thus appears that the external senses of fishes convey to them few lively or distinct impressions; and by whatever scenes in nature they are surrounded, their perceptions are probably indistinct and dull. Their sexual emotions, cold as their blood, indicate only individual wants. Few species pair, or enjoy any connubial gratification, for the males seek the eggs rather than the females which deposit them, and neither sex ever recognises its offspring. At least the exceptions to these generalities are extremely few, and the prevailing economy of fishes may be said in all these respects to be exactly the reverse of that of birds. These gay creatures of the sky have the power of surveying distinctly at a glance an immeasurable extent of horizon; their acute perception of hearing appreciates all sounds, and every intonation; and their glad voices are exquisitely skilled in their production. Though their bills be hard, and their bodies covered by down and feathers, they are by no means deficient in the sense of touch. They enjoy all the delights of conjugal and parental affection, and perform their incumbent duties with devotedness and courage; they cherish and defend their offspring, and will sometimes die in that defence; and of all the wonderful labours of instinctive art, none is so beautiful as the formation of their mossy dwellings. With what deep and continuous affection does the female brood over her cherished treasures! how unwearied is the gallant male in his tender assiduities, and in the rich outpouring of that varied song by which he seeks to soothe her sedentary task! The same principle of attachment and discrimination is even made available in a state of domestication by the skill of all-engrossing man. A bird acquires a knowledge of its master, and submits to and obeys that master's will; and the proud falcon, which in its natural state

its boldest flight at some familiar urchin's call. Other species will even imitate man's noblest faculty, the power of speech,—and it is thus with somewhat doubtful feelings that we deny to them the gift of reason.

But the silent dweller in the deep knows few attachments, expresses no language, cherishes no affections. Constructing no dwelling, he merely shelters himself from danger among the cavernous rocks of the ocean, or beneath the murky shade of the overhanging banks of rivers; and the cravings of hunger seem alone to exercise a frequent or influential action over his monotonous movements. We must not, however, suppose that the life of fishes is not one of enjoyment, for we know that the great Creator “careth for *all* his creatures;” and it ought perhaps rather to be said that we cannot appreciate the nature of their feelings, than that they are in any way fore-doomed to a negation of pleasure. Assuredly, however, the hand of nature has been most prodigal in bestowing on their external aspect every variety of adornment. Their special forms are infinite, their proportions often most elegant, their colours lively and diversified, and nothing seems wanting in them to excite the admiration of mankind. Indeed it almost appears as if this prodigality of beauty was intended solely for such an end. The brightness of metallic splendour, the sparkling brilliancy of precious gems, the milder effulgence of the hues of flowers, all combine to signalise fishes as among the most beautiful objects of creation. When newly withdrawn from their native element, or still gliding submerged in its liquid coolness, their colours, fixed or iridescent, are seen mingling in streaks or bands, or broader flashes, always elegant and symmetrical; sometimes richly contrasted, sometimes gradually softened into each other; and in all cases harmonizing with a chaste fulness of effect, which Titian or Rubens might envy, but could never equal. For what reason, then, it has been asked, has all this adornment been so lavishly bestowed on creatures which can scarcely perceive each other amid the dim and perpetual twilight of the deep? Shakspeare has already said that there are “more things in *heaven* and *earth* than are dream't of in our philosophy;” and we fear it is no answer to the foregoing question to add, that the same observation applies with even greater truth to the “*waters beneath the earth.*”

SECT. VI.—THE NUTRITION, MANDUCATION, AND DEGLUTITION OF FISHES.

The nutritive functions of fishes follow the same order of progression as those of the other vertebrated classes; they seize and in some measure divide their food with their teeth; they digest it in the stomach, from whence it passes into the intestinal canal, where it receives a supply of bile from the liver, and frequently a liquid similar to that of the pancreas; the nutritive juices absorbed by vessels analogous to lacteals, and probably taken up in part also directly by the veins, are mingled with the venous blood which is flowing towards the heart, from whence it is pushed to the branchiæ, in which, coming into contact with the water, it is converted into arterial blood, and then proceeds to the nourishment of the whole body. As in other animals, also, certain properties are carried off from the blood by transpiration, the secreting power of the kidneys, &c.

Fishes in general are extremely voracious, and the rule of “eat or be eaten” applies to them with unusual force. They are almost constantly engaged in the pursuit and capture of their prey; their degree of power in these respects depending of course on the dimensions of the mouth

Doth dally with the wind, and scorn the sun,

will wheel in airy circles over a well-trained dog, or stoop

¹ See *Hist. Nat. des Poissons*, t. i. chap. vi.

Introduc-
tion.

and throat, and the strength of the teeth and jaws. If the teeth are sharp and hooked, they are capable of securing the slenderest and most agile animals; if they are broad and strong, they are able to bruise the hardest aliment; if they are feeble or entirely wanting, they are only serviceable in procuring some inert or unresisting prey. Fishes indeed show but little choice in the selection of their food, and their digestive powers are so strong and rapid as to suffice to dissolve very speedily all kinds of animal substances. They greedily swallow other fishes, notwithstanding the sharp spines or bony ridges with which they may be armed; they attack and devour crabs and shell-fish, gulping them entire if they cannot otherwise attain their object; they do not object occasionally to swallow the young even of their own species, and the more powerful kinds carry their warfare into other kingdoms of nature, and revel on rats, reptiles, and young ducklings, to say nothing of the ferocious shark, which not seldom makes a meal even of the lord of the creation. The species which live chiefly on vegetable substances are few in number.

The growth of fishes depends greatly on the nature and supply of food, and different individuals of the same species exhibit a great disparity in their respective dimensions. They grow less rapidly in small ponds or shallow streams, than in large lakes and deep rivers.¹ The growth itself seems to continue for a great length of time, and we can scarcely set bounds to, certainly we know not with precision, the utmost range of the specific size of fishes. Even among species in no way remarkable for their dimensions, we ever and anon meet with ancient individuals, favourably situated, which vastly exceed the ordinary weight and measurement of their kind.

The teeth of fishes are sometimes spread over all the bones which envelope the cavities of the mouth and pharynx; on the maxillary, inter-maxillary, and palatine bones; on the vomer, the tongue, the branchial arches, and pharyngeal bones. In certain genera they exist on all those parts; while in others they are wanting on some, or are even entirely absent on all. The denominations of the teeth are derived from their position, that is, from the bones to which they are attached, and are consequently as numerous as the varieties of their situation. Their forms are not less varied than their stations, and give rise to terms still more numerous. The majority are conical or hooked, more or less acute. When these hooks are in considerable number, and disposed in several rows, or in quincunx, they are compared to those sharp points which beset the instruments called *cards*, used in the working of wool or cotton. It is to this form and distribution that we allude in the descriptive portion of the present treatise when we happen to use the French term *en carde*. Sometimes the teeth of fishes are slender, and so closely set together as to resemble to the eye the *pile* of velvet, in which case they are said to be *en velours*;² when they are at the same time extremely short and close, they are likened to smooth velvet; when feeble and elongated, they are said to be brushy or hair-like. Lastly, those kinds of teeth are sometimes so extremely small and short as to be reduced to mere asperities, sensible rather to touch than sight. The

whole are simple, and spring from an equally simple pulpy germ.

Introduc-
tion.

In the majority of osseous fishes, besides the lips, which, even when fleshy, having no peculiar muscles, can exert but little strength in retaining the aliments, there is generally in the inside of each jaw, behind the anterior teeth, a kind of membranous fold or valvule, formed by a replication of the interior skin, and directed backwards, of which the effect is to hinder the alimentary substances, and especially the water gulped during respiration, from escaping again by the mouth. This structure, as formerly supposed, does not constitute a character restricted to the genus *Zeus*, but exists in an infinity of fishes. The food seized by the teeth of the maxillæ, and detained by the valve just mentioned, is carried still farther back by the teeth of the palate and tongue when these exist, and is at the same time prevented by the dentations of the branchial arches from penetrating between the intervals of the branchiæ, where it might injure the delicate organs of respiration. The movements of the maxillæ and tongue can thus send the food only in the direction of the pharynx, where it undergoes additional action on the part of the teeth of the pharyngeal bones, which triturate or carry it backwards into the œsophagus. The last-named part is clothed by a layer of strong, close-set, muscular fibres, sometimes forming various bundles, the contractions of which push the alimentary matter into the stomach, thus completing the act of deglutition.³

SECT. VII.—THE CIRCULATION OF FISHES.

Fishes, in common with warm-blooded animals, are provided with a complete circulation for the body, and with another equally complete for the organs of respiration, and with a particular abdominal circulation terminating at the liver by means of the vena porta; but their peculiar character consists in this, that the branchial circulation alone is provided at its base with a muscular apparatus or heart, corresponding to the right auricle and ventricle of the higher classes, while nothing of the kind exists at the base of the circulating system of the body; in other words, the left auricle and ventricle are entirely wanting—the branchial veins changing into arteries without any muscular envelope.

The muscular apparatus of their circulation is composed of the auricle, the ventricle, and the bulb of the pulmonary artery, and the auricle itself is preceded by a large sinus, in which all the veins of the body terminate; a structure which gives rise to four cavities separated by restrictions, into which the blood must flow in its progress from the body to the branchiæ. Their size is small in proportion to the dimensions of the body, and does not increase in the same ratio with the growth of the individual. Three of these receptacles, the auricle, the heart, and the bulb, are lodged in a pericardium, which is itself placed beneath the pharyngeal bones, between the inferior parts of the branchial arches, and for the most part protected externally by the humeral bones. The great venous sinus is not placed in the pericardium, but between the posterior partition of that cavity and the membrane which represents the diaphragm,

¹ The writer of this treatise kept a minnow little more than half an inch long in a glass tumbler for a period of two years, during which time there was no perceptible increase in its dimensions. Had it continued in its native stream, subjected to the fattening influence of a continuous flow of water, and a consequent increase in the quantity and variety of its natural food, its cubic dimensions would probably have been twenty times greater; yet it must have attained, prior to the lapse of a couple of years, to the usual period of the adult state.

² The French expression of *dents en velours*, which so frequently occurs both in the *Règne Animal* and the *Hist. Nat. des Poissons*, is one of the many instances, as Dr M'Murtrie has remarked, in which Baron Cuvier's expressions bid defiance to all English synonyms.

³ The various notices (as already intimated) of the internal structure of fishes contained in the article COMPARATIVE ANATOMY of this work (vol. iii.) absolve us from the propriety of presenting any details regarding the form and constitution of the intestinal canal, and of certain other important interior organs of the class.

Introduc- and which is merely the anterior portion of the peritoneum strengthened by aponeurotic fibres. This sinus is extended transversely, and receives by several different trunks the veins of the liver, of the generative organs, of the kidneys, of the fins, branchiæ, and throat, and finally those of the head, which themselves partly pass by a sinus at the back of the cranium. The first-mentioned sinus sends the whole of this blood by a single orifice of its anterior convexity into the auricle, which receives it through the opening of its anterior portion. Two thin membranous valves protect this communication, and are turned towards the auricle. The latter organ is placed in the pericardium, in front of the great sinus, and above the ventricle, that is, on its dorsal aspect. It presents very various and often remarkable configurations. In osseous fishes it is usually of a tetrahedral form,—in the cartilaginous kinds more frequently rounded and depressed. It is situate beneath the auricle, the cavity being so turned as to be almost vertical next that organ, and horizontal towards the bulb. Its coats are extremely robust, and furnished internally with powerful fleshy columns, its substance being composed of two different layers. But it is in the bulb of the branchial artery that we find the most vigorous fibres, usually disposed in a circular form. The prolongation of this bulb issues from the pericardium, and becomes the branchial artery, advancing forward beneath the single chain of small bones which unites the arches of the branchiæ. The branchial artery soon divides, and in such a manner as to send a branch to each branchia. These branches pass along a hollow groove on the convexity of each branchial arch, and more external than the vein which follows the same track, but in an opposite direction. To the arch are attached a great number of leaflets, parallel to each other, usually terminated in a forked point, and sometimes deeply divided. The principal branch which passes along the groove of the arch gives a smaller branch to each of the leaflets; and this branch, after being twice bifurcated, furnishes an infinity of lesser branchlets, which meander over the surface of each leaflet, till they are finally converted into extremely minute veins. These little vessels meet on each side in a branchial vein, which proceeds along the internal margin of the lateral lobe of the leaflet, and the two veins open into the trunk of the great vein of the branchia.

On passing out of the dorsal side of the branchia, the branchial veins assume the structure and functions of arteries; even before their arrival at this point, the anterior have already sent several branches to different portions of the head; and it is necessary to remark, that the heart and several parts situate in the chest receive their blood from a branchial vein, by means of an offset issuing from near its source, and consequently anterior to its exit from the branchiæ. Nevertheless, it is only by the re-union of the trunks proceeding from the four branchiæ that the great artery is formed which carries the blood to the viscera and all the parts of the trunk, and which is by consequence the representative of the aorta of the Mammalia,—but of an aorta which possesses neither auricle nor ventricle at its base. Thus, according to Cuvier's views, the left cavities of the heart of quadrupeds do not exist in fishes, but are replaced by a simple vascular apparatus, situate above the branchiæ, in like manner as the right cavities are placed beneath them.

SECT. VIII.—THE RESPIRATION OF FISHES.

It is thus by an almost infinite subdivision of the vessels over the surface of the branchiæ or gills, that the blood of

fishes becomes subjected to the influence of an ambient fluid. This fluid is of course water, which is made to flow incessantly between the branchiæ by the movement of the jaws, and of the opercular and hyoidean apparatus. This mode of respiration is equally necessary to fishes, as the direct respiration of air is to other animals; but the action of water on the blood is much more feeble than that of air. It appears that it is neither the water itself, nor the oxygen contained in it, which effects the respiration, but the small portion of air which is held in solution or mingled with the water. If this is expelled by ebullition, fishes cannot live; and many species are obliged to rise frequently to the surface for the purpose of breathing atmospheric air. It is easy to suffocate various kinds, by keeping them beneath the surface, enclosed in a gauze net. In the respiration of fishes, as in that of other animals, both the atmospheric air and that contained in the water give out their oxygen. The absorption of the latter, however, is very trifling among these aquatics, for it has been calculated that a man consumes fifty thousand times more than is required by a tench. When fishes are deprived of water, they perish not so much for want of oxygen, as because their branchiæ become dry, and their blood can no longer circulate with freedom. Hence the species of which the branchial orifice is small, as the eel, or those which possess receptacles for moisture, like *Anabas* and *Ophicephalus*, long survive exposure; while such as have their gills greatly cleft and open, as the herring, expire almost instantly when withdrawn from their moist abode.

SECT. IX.—THE SWIMMING BLADDER OF FISHES.

One of the most remarkable and characteristic organs of fishes is the swimming bladder, commonly so called. In many genera it has no opening or external communication, and the air which it contains must therefore be the result of secretion. It is composed of an extremely fine internal tunic, and of another of a thicker texture and peculiar fibrous structure, remarkable for producing the finest kind of isinglass. It is enclosed within the general coating with which the peritoneum invests the other viscera. It is sometimes simple, as in perch, sometimes furnished with more or less numerous appendages, as in some of the haddock tribe, or branched, as in certain *Sciæna*.¹ Occasionally we find it divided, as it were, into two parts, by a restriction, as in the genus *Cyprinus*, many of the *Salmonidæ*, and others. The *Catostomæ* have it even divided into three. It is chiefly among the abdominal fishes that we find it communicating by a tube or tunnel with the intestinal canal, and either directly with the œsophagus, as in *Cyprinus*, or with the base of the stomach, as in the herring. That of the sturgeon opens into the former portion by means of a large orifice. The contents of the swimming bladder are usually found to be azote, mingled with some fractional parts of oxygen or carbonic acid. A difference of opinion, however, seems to exist regarding the proportion of oxygen, which is estimated as much greater both by Configliachi and Biot. Some physiologists appear to have regarded the swimming bladder as a true lung, which both admitted and returned the external air; but in many species the air-duct which connects the bladder with the gullet is entirely wanting; and in many others which remain constantly at prodigious depths, the quantity of oxygen gas in the swimming bladder is greater than in those the abode of which is near the surface. Indeed the oxygen is said to increase in quantity in proportion to the depth at which the species dwells. Carus considers it probable that the vessel in question performs a part analogous

¹ For representations of various forms of the swimming bladder of fishes, see Plate CCXCVII. figs. 3, 6, 7, & VOL. XII.

Introduc-
tion.

to that of the expiratory functions of the lungs in the higher classes, by not only separating excrementitious azote and superabundant oxygen from the blood, but even discharging those elements in such species as have this particular viscus provided with an air-duct.

The more obvious use, however, of this organ seems to be to maintain the fish in equilibrium, or to lighten or increase its relative weight, so as to cause an ascension or a sinking, in proportion as the bladder is compressed or expanded. This is probably effected by the contraction or dilatation of the ribs. At all events, it is certain, that when the air-bladder bursts, the fish remains at the bottom, usually turning up its belly, and exhibiting other irregularities in its locomotion. Another curious effect is observable in regard to fishes which have been suddenly brought from a great depth by means of a long fishing line, and which having no time either to compress or partially empty the organ in question, the air which it contains being no longer pressed by the heavy weight of water, either expands so as to burst the bladder, or by its dilatation forces the stomach and œsophagus into the fish's mouth. When the air-bladder is pierced artificially, the fish almost immediately turns upon its back, and sinks to the bottom.

We have already alluded to the physiological opinion which regards this organ as an auxiliary to the respiratory system, and have likewise adverted to the argument against that opinion, deduced from the fact of its being imperforate in many species, and entirely wanting in others. We may add, that Weber¹ has pointed out a remarkable connection between the swimming bladder and the organs of hearing. It would appear that the former in several instances subserves the latter as a membrana tympani; but its primary, or at least most important purpose, seems to be to regulate the ascending or descending movements. Though of the highest importance in the structure of such species as possess it (and these are by far the greater number), yet the swimming bladder is not indispensable in the general economy of the class of fishes. In several genera (*e.g.* *Pleuronectes*) it is entirely wanting, and the species in such cases generally remain at the bottom, and, swimming obliquely on one side, propel themselves forward by a nearly vertical motion of the tail. In such cases both eyes are on the same side, and the whole structure of the fish, especially the skeleton of the head, presents an unsymmetrical aspect of a very extraordinary kind.² In many cartilaginous fishes, such as rays (commonly called skates), the absence of the swimming bladder seems compensated by the enormous size of the pectoral fins, which, of all the external organs, are probably the most efficient in raising the body, as the caudal extremity is the power chiefly employed during an onward course. The lamprey, which has neither swimming bladder nor pectoral fins, dwells in the mud. Flat fishes being unprovided with swimming bladders, are supposed for that reason to raise themselves with difficulty to the surface; and they do not appear to strike the water laterally like other fishes, but swim rather after the manner of the Cetacea, by a motion alternately up and down. In all the other animals of this class the chief organ of progressive motion is the tail, or prolongation of the body, terminated by a caudal fin, the position of which, unlike that of the great aquatic mammalia called whales, is vertical. The reason of the difference is obviously this: A true fish, possessing the power of extracting air from water by means of its gills, does not (except at rare intervals) require to mount to the surface for the performance of the vital act of respiration; but all cetaceous animals

being furnished with lungs, which cannot perform their functions except through an immediate communication with the atmosphere, require their bodies to be terminated by a horizontal expansion, the action of which is the most efficient for an ascending course.

It is, however, difficult to account for the fact that so considerable an organ as the swimming bladder should have been denied to so many species, not only of the more indolent kinds, which dwell composedly at the bottom of the waters, but to many others which yield to none of their class in the ease and velocity of their movements. Its presence or absence does not even accord with the other conditions of organization; for while it is wanting in the common mackerel, it is found to occur in a closely allied species, the *Scomber pneumatophorus* of Laroche.

Another singular peculiarity connected with the organization of certain fishes may be also shortly noticed in this place, we mean the power of conveying electrical shocks. In Torpedos, the apparatus consists of membranous tubes filled with mucous matter, divided by transverse chambers closely set together, like the cells of honeycomb, and disposed in two groups placed on each side of the head. They receive enormous branches of nerves from the fifth and eighth pair. In the *Gymnotus* this extraordinary structure occupies the under surface of the body throughout its entire extent, and to a considerable thickness. It is composed of parallel plates separated by thin layers of mucilage. The effect of this natural galvanic pile will be detailed in the course of the systematic portion of this article, when we shall have occasion to mention the electric fishes in their proper place.

SECT. X.—THE GENERAL POSITION AND RELATIONS OF FISHES, CONSIDERED AS A GREAT CLASS IN THE ANIMAL KINGDOM.

It results not less from this general exposition of the structure of our present class, than from all observation of special organization, that fishes form a class of animals distinct from every other, and destined by the totality of their conformation to live, move, and have their being in the waters. The liquid element forms their proper place in the creation; there they had their origin, there they must remain till the final consummation of all things,—and it is either through slight and superficial approximations, or by vain metaphysical speculation, that any modern writer could regard them as proceeding from an exalted or more perfect development of the molluscos tribes. Equally unfounded is of course that other and corresponding opinion, which, in the spirit of the same philosophy, looks upon fishes as forming an elementary stage, or foetal condition, of the other vertebrated classes. It is true that the Mollusca, in common with fishes, respire by means of branchiæ; they equally possess a nervous and circulating system, an intestinal canal and a liver; “and nobody,” says Cuvier, with a justifiable pride, “knows these things better than I, who was the first to make known with any degree of completeness the anatomy and zoological relations of the molluscos tribes.” As animal life, he continues,³ has received but a limited number of organs, it necessarily happens that some of these organs are common to several classes. But where is in other respects the resemblance? The skeleton of these animals, and their entire system of locomotion, are they comparable in the least of their parts? And even such organs as are

¹ *De Aure et Auditu*, &c.

² In several insects of the genus *Blatta* we have observed a want of symmetry both in the size and markings of the elytra. We do not mean an accidental variation of one side, but an evidently pre-ordained disparity of form and colour.

³ *Hist. Nat. des Poissons*, t. i. p. 544.

Introduc-
tion.

Introduc-
tion.

common alike to the Mollusca and to fishes, can they be brought into relation with those connections which the latter exhibit with the other vertebrated classes? By what passage does nature conduct us from the one to the other? It is certainly by no means difficult, while disregarding numerous disagreements, so to compose a definition as to embrace only those points which they possess in common; but that definition assuredly will always repose upon a pure abstraction of the mind, a definition simply nominal, an assemblage of vain words, which can never be represented by a harmonious and existing plan, notwithstanding whatever extraneous details may be collected or conceived in support of such visionary views. By a like procedure, there is in truth no two things, however remote or dissimilar, which may not be so allied; for, whatever their disresemblance, there will always be some particular point or other in which they may be found to agree. But when we look to the characters in which objects differ, we shall find reason to view the subject in another light. The heart itself in those Mollusca which have only one, is placed in a contrary mode from that of fishes; it is at the junction of the branchial veins and arteries of the body that that organ is attached; in several the members are placed upon the head, in others the generative system is lateral, and frequently the respiratory organs are placed above those of digestion, and extend more or less over the dorsal surface. Perhaps all that can be said regarding any positive or important relationship between Mollusca and fishes is, that both classes are possessed of branchiæ.

It may indeed be observed, that whenever we proceed from these purely verbal or metaphysical formula, we find ourselves lost among the most inadmissible comparisons. According to one theorist, the shells of bivalves represent the opercula of fishes; according to another, the buckler of the cuttle-fish is a true fibrous bone; according to a third, the large scales of the sturgeon, and the spines of the diodons, are to be regarded as an external skeleton. Others search for the desired analogies among the Crustacea, of which the margins of the thorax represent the opercula. Beneath these margins the branchiæ actually occur, but if we continue the comparison, all is changed. The medullary cord is towards the abdomen, the heart towards the back, and the latter organ, as among the Mollusca, receives the blood from the branchiæ, but does not send it thither. Finally, some observers, apparently despairing of their transcendental cause, perceive the rays or spiny apophyses of vertebrated animals in the legs of the Crustacea, forgetting that, were it so, an obvious degradation rather than amelioration of organic structure must have befallen the class of fishes.

The affinity of fishes to other classes of vertebrated animals is much better founded. At least we here find the commencement of sensible relations in the number of organic systems, and in their mutual connections; but we are still far from discovering a progressive and continuous course. We cannot in this place report the conclusive reasoning of Baron Cuvier regarding the distinctions of these classes. We shall merely state his conclusion to be, that if there is a resemblance between the organs of fishes and those of the other great groups of the animal kingdom, it is only in so far as the functions of such organs are similar; that if we assert either that fishes are Mollusca of an ameliorated or higher grade, or that they represent a commencing or fœtal state of reptiles, we can do so only in an abstract or metaphysical acceptance, and that even with that restriction we by no means convey an accurate notion of their organic structure; that we cannot regard them either as links of an imaginary chain of successive forms (of which none could serve as the germ of another, since none is capable of a solitary or isolated

existence), nor of that other chain, not less fanciful, of simultaneous and transitional forms, which has no reality but in the imagination of certain naturalists, more poetical than observant. They pertain in truth, and solely, to the actual chain of co-existent beings,—of beings necessary to each other, and which by their mutual action maintain the resplendent order and harmony of created things.

These are thy glorious works, Parent of good,
Almighty! Thine this universal frame,
Thus wondrous fair; Thyself how wondrous then!
Unspeakable, who sitt'st above these heavens,
To us invisible, or dimly seen
In these thy lowest works; yet these declare
Thy goodness beyond thought, and power divine.

SECT. XI.—THE CLASSIFICATION OF FISHES.

The class of fishes is of all others the most difficult to divide into orders, according to fixed and perceptible characters. We shall here give a brief view of Baron Cuvier's arrangement, the details of which we shall afterwards exhibit in our systematic view.

Fishes are divisible, in the first place, into two great and distinct series, viz. FISHES PROPERLY SO CALLED, embracing the great majority of species; and CHONDROPTERYGIAN or CARTILAGINOUS FISHES, such as sharks and rays.

The general character of the latter series consists in the absence of the bones of the upper jaw, the place of which is supplied by those of the palate. Their entire structure also exhibits sundry analogies, to be afterwards described. Cartilaginous fishes are further divisible into three principal orders.

1st. CYCLOSTOMI, the jaws of which are soldered into an immoveable ring, and the branchiæ open by means of numerous holes. Example, the *Lamprey*.

2d. SELACHI, which possess the branchiæ of the Cyclostomi, but not their jaws. Example, *Sharks*.

3d. STURIONES, of which the branchial opening is in the usual fissure-like form, and furnished with an opercle. Example, *Sturgeons*.

The other great series, or that of the ORDINARY FISHES, presents a first subdivision into those in which the maxillary bone and the palatine arch are fixed to the cranium. They constitute Cuvier's order PLECTOGNATHI, which comprises two families, the GYMNOBONTES and SCLERODERMI. Examples, the genera *Diodon* and *Ostracion*.

The next subdivision of the ordinary fishes contains certain species with perfect jaws, but the branchiæ of which, instead of being comb-shaped, resemble a series of small tufts. They constitute an order called LOPHOBANCHII, which comprises the two genera SYNGNATHUS and PEGASUS of Linn. Example, the *Pipe-fish*.

Of the ordinary fishes there then remains an immense assemblage, to the general classification of which no other characters can be applied than those of the external organs of motion. After a long and laborious research, Baron Cuvier became satisfied that the least objectionable of these characters is still that long ago employed by Ray and Artedi, drawn from the nature of the first rays of the dorsal and anal fins. Thus the great body of the ordinary fishes is divided into MALACOPTERYGII, in which all the rays are soft, with the occasional exception of the first of the dorsal, or of the pectorals; and ACANTHOPTERYGII, in which the first portion of the dorsal, or the first dorsal if there are two fins of that kind, is always supported by spinous rays, and where some similar spines are also found in the anal fin, and at least one in each of the ventrals.

Of these two last-mentioned groups, the former, or

Introduction.

Malacopterygii, may be conveniently subdivided according to the position of the ventral fins, whether situate behind the abdomen, suspended to the apparatus of the shoulder, or entirely wanting. This view furnishes us with three great orders, the MALACOPTERYGII ABDOMINALES (such as pike, salmon, and herring), the M. SUBBRACHIATI (such as cod, haddock, and flat fish), and the M. APODES (such as eels).

But such a basis of subdivision is altogether inapplicable to the remaining group of ordinary fishes, viz. the ACANTHOPTERYGII, which at present can only be placed together in a certain series of natural families. Fortunately, several of these families are possessed of characters almost as precise as those which could be assigned to genuine orders. It is, however, impossible to assign to the families of fish the same marked gradation so perceptible among those of the Mammalia. Thus the Chondropterygians are related to serpents on the one hand by the organs of the senses, and in certain cases even by the generative system; while, on the other, they bear an alliance to the Mollusca and worms in the occasional imperfection of their skeleton.

Before proceeding with our systematic exposition of the minor divisions, we shall present our readers with a sketch of Baron Cuvier's views regarding the general character and relations of certain groups. After forty years devoted to the study of Ichthyology, that great observer became convinced that no acanthopterygian species ought to be mingled in classification with the fishes of other families, as attempted by many of his predecessors; and he also came to the conclusion that the acanthopterygian order, which comprises about three fourths of the entire class, contains the characteristic type, and is the most accordant and homogeneous, even amid all the variations which it undergoes.

The acanthopterygian character prevails over all the others, and these ought to be employed only as subservient to it, and never in opposition; but the extreme constancy of the general plan, and the predominating influence of the regulating character, render it a matter of greater difficulty to apply precise and perceptible characters of a subordinate nature. It is thus that the various families of the acanthopterygian order pass so insensibly from one to another, that we are often at a loss to define the transition. The family of Percidæ, for example, which is essentially distinguished from that of the Sciænidæ by its palatinal teeth, comprises a group of some extent, and extremely natural in its construction, which yet contains a portion of species possessed of those teeth, while the other portion is without them. The same thing happens in the family with mailed cheeks (joints cuirassées), the majority of which are allied to the perches,—the others to the Sciænidæ. The sciænoid genera themselves approach in part to the Chatodontes in the scales which in several instances more or less cover their vertical fins, and yet it is necessary to assimilate them still more closely to the Sparidæ, by reason, in many other instances, of the entire absence of those scales.

The malacopterygian families are distinguished by stronger and more obvious differences, and several of them are not only natural, but subjected to fixed limits, so that each, in its separation from the other, preserves within itself a great resemblance in details. This precision is so sensible, that the majority of natural families established by Cuvier in this part of the class had been already signalled by Artedi as generic groups. His *Siluri*, *Cyprini*, *Salmones*, *Clupeæ*, and *Esores*, may remain unbroken, and there is even no inconvenience in distributing them according to the position of the ventral fins, because in those genera the character in question, however trivial in itself, is constant; but it is clearly impossible to preserve

Introduction.

the distinction of jugular, thoracic, and abdominal fishes, in the mode established by Linnæus. It is, as Cuvier observes, of small consequence, in fact, whether the ventrals manifest themselves externally a little before or a little behind the pectorals, or immediately beneath them; but the circumstance of importance, as connected with the structure of the fish, is to ascertain whether the pelvis be attached to the bones of the shoulder, or whether it is simply suspended in the muscles of the abdomen. To designate the fish belonging to the former category, the name of *Sub-brachians* has been bestowed by Cuvier, and that without any reference to the external position of the ventrals,—that circumstance being dependent on the greater or less extent of the bones of the pelvis. To those of the second category he leaves the older name of *Abdominals*. Lastly, the term *Apodes* naturally designates the Malacopterygians destitute of ventral fins.

Cuvier's systematic exposition of fishes commences with the Acanthopterygians, which constitute in reality only a single family of vast extent. He then places in succession the various families of Malacopterygians, in the order in which they seem allied to the preceding great division; but he guards the student from inferring that these relations follow only in a single line or series. If the abdominal Malacopterygians may be so arranged, and may even be made to commence with those which possess some spiny rays, they are not followed in so natural a succession by either the apodal or sub-brachian tribes. The *Gadi*, for example, are as nearly related as any of the Abdominals to certain species of the acanthopterygian order, and there would be no reason for placing them after the Abdominals if the question were mooted respecting the station they should hold in nature. If they are actually arranged subsequent to the latter in our systems, it is because the exposition of facts in a book necessarily requires a successive order.

The spirit of the same observation is applicable to the rest of the fishes;—to those of which the upper jaw is fixed (*Plectognathi*),—to such as have tufted branchiæ (*Lophobranchii*),—and, above all, to the great and important series of Chondropterygians, which terminate the class. It is indeed chiefly among those last mentioned that we perceive the futility of whatever system seeks to arrange the objects of creation in a single line. Several of the genera alluded to, the rays and sharks, for example, may be said to rise above the rank of ordinary fishes by the complicated nature of some of their organs of sense, and by that of the generative system, which is more fully developed in some particulars than even that of birds;—while other genera of the same series, and at which we arrive by graduated transitions, such as the Lampreys and Ammocætes, become so simplified in their structure, that they have even been regarded as affording a connecting link between the class of fishes and that of the articulated worms. The genus *Ammocætes* certainly possesses no skeleton, and its muscular apparatus is attached solely to tendinous or membranous supports.

Let it not therefore be imagined, says Cuvier, that because one genus or family is placed anterior to another, it is for that reason to be regarded as more perfect, or superior to those that follow. He alone will indulge in that fond fancy, who pursues the chimerical project of ranging beings in a single series,—a project, be it remembered, now renounced by philosophy. The further we advance into the penetralia of the temple of nature, the more we shall feel convinced that a false notion was never entertained in relation to natural history. Genuine systems view each being not as intermediate merely to two others, but as central among many;—they show the wonderful radiations that link it more or less immediately with the vast web of organic life; and it is by such extended views alone that

Introduc- we shall acquire ideas worthy of nature and of nature's
tion. God. It is therefore not so much in the position which a
being occupies in our published systems, which are neces-
sarily linear or consecutive, that we are to seek for those
multifarious relations, or for the actual degree of organisa-
tion,—but in accurate descriptions of structure afforded
by those who possess the use of their eyes and pen. It
is not, however, to be in any way maintained that no di-
rect classification is possible, or that species should not be
formed into groups, and embraced by definitions. These
approximations are on the contrary so real, that the natu-
ral understanding of man has ever inclined towards them,
and in all ages and countries the vulgar as well as the
learned have formed their genera. It is in truth one of
the great objects of science to render the various groups

Introduc- into which, for our own convenience, we must arrange the
tion. objects of creation, as natural in themselves, and as near-
ly related to their neighbours, as is consistent with the ne-
cessity of placing them in our descriptive systems in a
single fixed position,—a position, be it remembered, in
which their numerous and mixed relations can neither be
philosophically exhibited nor fully expressed.

We here terminate our introductory chapter, or gene-
ral exposition of the class of fishes, and shall now proceed
to a detailed enumeration of the characters of the principal
genera, adding, as occasion requires, a succinct descrip-
tion and history of the most interesting or important spe-
cies. We give in a note below a tabular abstract of the
Ichthyological System.¹

¹ *Systematic View of the Orders, Families, Genera, and Sub-genera of Fishes, according to the arrangement of Baron Cuvier.*

N. B.—In this abstract we follow the system of the *Règne Animal*, as sufficing for a tabular view; but in the body of our article we shall introduce notices of such new or amended genera as have been signalised by our illustrious guide in those volumes of the *Hist. Nat. des Poissons*, which have made their appearance posterior to the publication of the second edition of the *Animal Kingdom*.

CLASS FISHES.

First Great Series, called ORDINARY or OSSEOUS FISHES.

ORDER I.—ACANTHOPTERYGII.

FAMILY I.—PERCIDÆ.	Priacanthus.
<i>With thoracic ventrals.</i>	Dules.
<i>Seven branchial rays, two dorsals,</i>	Therapon.
<i>teeth small and crowded.</i>	Datnia.
	Pelates.
	Helotes.
Perca.	<i>Two dorsals.</i>
Labrax.	Trichodon.
Lates.	Sillago.
Centropomus.	<i>With more than seven branchial</i>
Grammistes.	<i>rays.</i>
Aspro.	Holocentrum.
Huro.	Myripristis.
Etelis.	Beryx.
Nippon.	Trachichthys.
Enoplosus.	<i>With jugular ventrals.</i>
Diploprion.	Trachinus.
Apogon.	Percis.
Cheilodipterus.	Pinguipes.
Pomatomus.	Percophis.
<i>Some of the teeth long and pointed.</i>	Uranoscopus.
Ambassis.	<i>With abdominal ventrals.</i>
Iucio-Perca.	Polynemus.
<i>With a single dorsal, and canine</i>	Sphyraena.
<i>teeth.</i>	Paralepis.
Serranus.	Mullus.
Serranus proper.	Mullus proper.
Anthias.	Upeneus.
Merrus.	
Plectropoma.	
Diacope.	FAMILY II.—BUCCÆ LORICATÆ,
Mesoprion.	OR MAILED CHEEKS.
<i>With a single dorsal, and small</i>	Trigla.
<i>crowded teeth.</i>	Trigla proper.
Acerina.	Prionotus.
Rypticus.	Peristedion.
Polyprion.	Dactylopterus.
Centropristis.	Cephalacanthus.
Gristes.	Cottus.
<i>With less than seven branchial rays.</i>	Cottus proper.
<i>A single dorsal, and some canine</i>	Aspidophorus.
<i>teeth.</i>	Hemitripterus.
Cirrhitæ.	Hemilepidotus.
<i>A single dorsal, all the teeth small</i>	Platycephalus.
<i>and crowded.</i>	Scorpena.
Chironemus.	Scorpena proper.
Pomotis.	Tænianotes.
Centrarchus.	Sebastes.
	Pterois.

Blepsias.	Pentapoda.
Apistus.	Iethrinus.
Agriopus.	Cantharus.
Pelor.	Boops.
Synanceia.	Oblada.
Menocentris.	
Gasterosteus.	FAMILY V.—MENIDÆ.
Oreosoma.	Mæna.
	Smaris.
FAMILY III.—SCIÆNIDÆ.	Cæcio.
<i>With two dorsals.</i>	Gerres.
Sciæna.	FAMILY VI.—SQUAMMIPENNES.
Sciæna proper.	Chaetodon.
Otolithus.	Chaetodon proper.
Ancylodon.	Chelmon.
Corvina.	Heniochus.
Johnius.	Ephippus.
Umbrina.	Taurichthes.
Pogonias.	Holocanthus.
Eques.	Pomocanthus.
<i>With one dorsal, and seven bran-</i>	Platax.
<i>chial rays.</i>	Psettus.
Hæmulon.	Pimelepterus.
Pristipoma.	Dipterodon.
Diagramma.	Brama.
<i>With less than seven branchial rays,</i>	Pempheris.
<i>the lateral line continuous.</i>	Toxotes.
Iobotes.	FAMILY VII.—SCOMBERIDÆ.
Cheilodactylus.	Scomber.
Scolopsides.	Scomber proper.
Micropterus.	Thynnus.
<i>With less than seven branchial rays,</i>	Orcynus.
<i>the lateral line interrupted.</i>	Auxis.
Amphiprion.	Sarda.
Premnas.	Cybium.
Pomacentrus.	Thyrsites.
Dascyllus.	Gempylus.
Glyphisodon.	Xiphias.
Heliasus.	Xiphias proper.
	Tetrapturus.
FAMILY IV.—SPARIDÆ.	Makaira.
Sparus.	Histiophorus.
Sargus.	Centronotus.
Chrysophris.	Naucrates.
Pagrus.	Elacates.
Pagellus.	Lichia.
Dentex.	Trachinotus.

FIRST GREAT SERIES OF THE CLASS OF FISHES.

ORDINARY OR OSSEOUS FISHES.

ORDER I.—ACANTHOPTERYGII.

These, as already mentioned, form much the most numerous division of the class. They are distinguished by the spines, which occupy the place of the first rays of the dorsal fin, or which alone sustain the anterior dorsal when there are two. Sometimes, instead of an anterior dorsal, there are only a few free spines. The first rays of their anal fin are also spinous, and there is generally one of a similar nature to each of the ventrals. The Acanthoptery-

gians bear so many relations to each other,—their several natural families exhibit so many variations in the apparent characters which one might suppose capable of indicating orders or other subdivisions,—that it has been found impossible to divide them, otherwise than by those natural families themselves, which are thus left without any higher combinations.

FAMILY I.—PERCIDÆ.

So named because well typified by the common perch. Their bodies are of an oblong form, covered with scales, which are generally hard and rough; the opercle and preopercle, and frequently both, have the margins toothed or

Rhinchobdella.
Macrogathus.
Mastacembelus.
Notocanthus.
Seriola.
Nomeus.
Temnodon.
Caranx.
Caranga.
Citula.
Vomer.
Olistus.
Seyris.
Blepharis.
Gallus.
Argyreus.
Vomer proper.
Zeus.
Zeus proper.
Capros.
Lampris.
Equula.
Mene.
Stromateus.
Pampla.
Peprilus.
Luvarus.
Seserinus.
Kurtus.
Coryphæna.
Coryphæna proper.
Caranxomorus.
Centrolophus.
Astrodermus.
Pteraclis.

FAMILY VIII.—TÆNIOIDÆ.

The muzzle elongated, teeth strong.

Lepidopus.
Trichiurus.

The muzzle short, mouth small.

Gymnetrus.
Stylephorus.

The muzzle short, mouth cleft, head obtuse.

Cepola.
Lophotes.

FAMILY IX.—THEUTIDÆ.

Siganus.
Acanthurus.
Prionurus.
Naseus.
Axiurus.
Priodon.

FAMILY X.—LABYRINTHIFORM
PHARYNGEALS.

Anabas.
Polyacanthus.

Macropodus.
Helostoma.
Ospromenus.
Trichopodus.
Spirobranchus.
Ophicephalus.

FAMILY XI.—MUGILIDÆ.

Mugil.
Tetragonurus.
Atherina.

FAMILY XII.—GOBIDÆ.

Blennius.
Blennius proper.
Pholis.
Myxodes.
Salaria.
Clinus.
Cirriharba.
Gunellus.
Opistognathus.
Zoarcus.
Anarrhicas.
Gobius.
Gobius proper.
Gobioides.
Tænioides.
Periopthalmus.
Eliotris.
Callionymus.
Trichonotus.
Comphorus.
Platypterus.
Chirus.

FAMILY XIII.—PECTORALES
PEDICULATI.

Lophius.
Lophius proper.
Chironectes.
Malthe.
Batrachus.

FAMILY XIV.—LABRIDÆ.

Labrus.
Labrus proper.
Cheilinus.
Lachnolaimus.
Julis.
Anampses.
Crenilabrus.
Coricus.
Epibulus.
Clepticus.
Gomphosus.
Xirichthys.
Chromis.

Cyehla.
Plesiops.
Malacanthus.
Scarus.
Calliodon.
Odax.

ORDER II.—MALACOPTERYGII ABDOMINALES.

FAMILY I.—CYPRINIDÆ.

Cyprinus.
Cyprinus proper.
Barbus.
Gobio.
Tinca.
Cirrhinus.
Abramis.
Labeo.
Catastomus.
Leuciscus.
Chela.
Gonorhynchus.
Cobitis.
Anableps.
Pæcilia.
Lebias.
Fundulus.
Molinesia.
Cyprinodon.

FAMILY II.—ESOCIDÆ.

Esox.
Esox proper.
Galaxias.
Alepocephalus.
Microstoma.
Stomias.
Chauliodus.
Salanx.
Belone.
Scomberesox.
Hemiramphus.
Exocetus.
Mormyrus.

FAMILY III.—SILURIDÆ.

Silurus.
Silurus proper.
Schilbe.
Mystus.
Pimelodes.
Bagrus.
Pimelodes proper.
Synodontis.
Ageneiosus.
Doras.
Heterobranchus.
Macropteronotes.
Plotosus.
Callichthys.

FAMILY XV.—FISTULARIDÆ.

Fistularia.
Fistularia proper.
Aulostomus.
Centriscus.
Centriscus proper.
Amphisila.

FAMILY IV.—SALMONIDÆ.

Salmo.
Salmo proper.
Osmerus.
Mallotus.
Thymallus.
Coregonus.
Argentina.
Characinus.
Curimata.
Anostomus.
Gasteropelecus.
Piabucus.
Serrasalmo.
Tetragonopterus.
Chalceus.
Myletes.
Hydrocyon.
Citharinus.
Saurus.
Scopelus.
Aulopus.
Sternopyx.

FAMILY V.—CLUPIDÆ.

Clupea.
Clupea proper.
Alosa.
Chatoessus.
Odontognathus.
Pristigaster.
Notopteris.
Engraulis.
Tribryssa.
Megalops.
Elops.
Butirinus.
Chirocentrus.
Hyodon.
Erythrinus.
Amia.
Sudis.
Osteoglossum.
Lepisosteus.
Polypterus.

Acanthop-
terygii.
Percidæ.
spiny; and the jaws, the front of the vomer, and almost al-
ways the palatine bones, are furnished with teeth.
The species of this family are extremely numerous, espe-
cially in the tropical seas. Their flesh is in general
wholesome, and of an agreeable flavour. By far the great-
er number have their ventral fins attached beneath the
pectoral, and thus form a first division, named

THORACIC PERCIDÆ.¹

A. Seven branchial rays; two dorsal fins.

a. All the teeth small and crowded.

GENUS PERCA, Cuv. Pre-opercle dentated; bony
opercle terminated by two or three sharp points; tongue
smooth. Sometimes the sub-orbital and humeral bones are
slightly dentated.

The common perch (*Perca fluviatilis*, Linn.), Plate
CCXCVIII. fig. 1, one of the most beautiful of the fresh-
water fishes of Europe, is too familiarly known to require de-
scription. It inhabits both lakes and rivers, but shuns salt
water.² As an article of food it is still in some estimation,
although the character given of it in that respect by Au-
sonius is higher than accords with modern views. The
female deposits her ova, united together by a viscid matter,

in lengthened strings, a peculiarity noted by Aristotle. Acanthop-
terygii.
Percidæ.
The number of these eggs sometimes amounts to nearly a
million. The perch occurs over all Europe, and most of
the northern districts of Asia. Pennant alludes to one
said to have been taken in the Serpentine River, in Hyde
Park, which weighed nine pounds. But even one half of
that weight would be regarded as extraordinary in the pre-
sent species.

The *Perca Italica* occurs in the south of Europe, and is
distinguished by the want of the black bands so conspicu-
ous in the common kind. Several other species are found
in North America. *P. ciliata* is a native of Java; and *P.*
trutta occurs in Cook's Strait, New Zealand.

GENUS LABRAX, Cuv. Distinguished from the preced-
ing by scaly opercula terminating in two spines, and by
the roughness of the tongue.

To this genus belongs the basse or sea-perch (*P. labrax*,
Linn.; *Labrax lupus*, Cuv.), Plate CCXCVIII. fig. 2, a fish
of a chaste and pleasing aspect, though destitute of the
more strongly contrasted colours of the fresh-water spe-
cies. Its upper parts are gray, with bluish reflections,
which gradually shade away into a silvery whiteness on
the under surface. The pectoral fins are slightly tinged with
red. It occurs along the Dutch and British shores, but is

ORDER III.—MALACOPTERYGII SUB-BRACHIATI.

FAMILY I.—GADIDÆ.

Gadus.
Morhua.
Merlangus.
Merluccius.
Lota.
Motella.
Brosmius.
Brotula.
Phycis.
Raniceps.
Macrourus.

Hippoglossus.
Rhombus.
Solea.
Monochirus.
Achirus.
Plagusia.

FAMILY III.—DISCOBOLI.

Lepadogaster.
Lepadogaster proper.
Gobiesox.
Cyclopterus.
Lumpus.
Liparis.
Echeneis.

FAMILY II.—PLEURONECTIDÆ.

Pleuronectes.
Platessa.

Synbranchus.
Alabes.
Saccopharynx.
Gymnotus.
Gymnotus proper.
Carapus.
Sternarchus.

Gymnarchus.
Leptocephalus.
Ophidium.
Ophidium proper.
Fieraster.
Ammodytes.

ORDER V.—LOPHOBRANCHII.

Syngnathus.
Syngnathus proper.
Hippocampus.

Solenostomus.
Pegasus.

ORDER VI.—PLECTOGNATHI.

FAMILY I.—GYMNODONTES.

Diodon.
Tetrodon.
Orthogoriscus.
Triodon.

FAMILY II.—ECLERODERMI

Balistes.
Balistes proper.
Monocanthus.
Aluterus.
Triacanthus.
Ostracion.

ORDER IV.—MALACOPTERYGII APODES.

FAMILY I.—ANGUILLIFORMES.

Muraena.
Anguilla.
Anguilla proper.

Conger.
Ophisurus.
Muraena proper.
Sphagebranchus.
Monopterus.

Second Great Series, called CHONDROPTERYGII, or CARTILAGINOUS FISHES.

ORDER I. (7th of the entire Class.)—STURIONES, or CHON-
DROPTERYGII WITH FREE BRANCHIÆ.

Acipenser.
Spatularia.

Chimæra.
Chimæra proper.
Callorhynchus.

Mustelus.
Notidanus.
Selache.
Cestracion.
Spinax.
Centrina.
Scymnus.

Trygon.
Anacanthus.
Myliobatis.
Rhinoptera.
Cephaloptera.

ORDER II. (8th of the entire Class.)—CHONDROPTERY-
GII WITH FIXED BRANCHIÆ.

FAMILY I.—SELACHII.

Squalus.
Scyllium.

Squalus proper.
Carcharias.
Lamna.
Galeus.

Zygæna.
Squatina.
Pristis.
Raia.
Rhinobatus.
Rhina.
Torpedo.
Raia proper.

FAMILY II.—SUCTORII.

Petromyzon.
Myxine.
Heptatremus.
Gastrobranchus.
Ammocætes.

¹ Almost all the species were included by Linnæus in his genus PERCA, but Cuvier has divided them, as shown above, according to the amount of the rays of the branchiæ, the number of the dorsal fins, and the nature of the teeth.

² Pallas, however, is said to have remarked, in a work, we believe, still unpublished (*Zoographia Russo-Asiatica*), that about spawn-
ing time both pike and perch are found in a gulf of the Caspian Sea, about thirty verstes from the mouth of the Terek.

*Acanthop-
terygii.
Percidæ.* much more abundant in the Mediterranean. It is a voracious fish, remarkable for the size of its stomach, and was known to the ancients under the appropriate name of *lupus*.

GENUS LATES, Cuv. Scarcely differs from *Perca*, except in having deep dentations, and even a small spine at the angle of the pre-opercle, and by stronger dentations also on the sub-orbital and humeral bones.

We shall here notice only the *L. Niloticus*, the largest and one of the finest-flavoured fishes of the celebrated Nile. It is altogether of a silvery tint, tinged on the upper parts and fins with olive brown. Individuals of a very great size are sometimes found in Upper Egypt, and, according to Paul Lucas, the species occasionally attains to the weight of 300 pounds. Other kinds occur in India, where they are highly esteemed as food.

GENUS CENTROPOMUS, Lacépède. Pre-opercle dentated; opercle obtuse, and unarmed.

C. undecimalis, Cuv. is a large and excellent fish, known along a great extent of the South American shores, where it is much used as an article of consumption, under the name of *brochet* or pike. In the form of its muzzle, and general shape, it somewhat resembles that fresh-water fish, and indeed it frequently ascends the great rivers to a considerable height. A kind of caviar is made of its roe. It attains to the weight of twenty-five pounds.

GENUS GRAMMISTES, Cuv. Opercle and pre-opercle spined, but not dentated; dorsal fins approximate; scales small, as if sunk beneath the epidermis; anal fin without apparent spine.

Of this genus there seems to be only a single species, *G. orientalis*, a small fish, native to the Indian seas.

GENUS ASPRO, Cuv. Body elongated; dorsals not approximate; ventrals broad; teeth small and close (en velours); head depressed; muzzle reaching beyond the mouth, and terminating in a rounded point.

We are acquainted with only two species of this genus, both of which are known in the fresh waters of the continent of Europe. We have represented *A. vulgaris* (*Perca asper*, Linn.), on Plate CCXCVIII. fig. 3. It is a small fish, rarely exceeding half a foot in length, common in the Rhone, especially between Lyons and Vienne.

We shall here pass over some limited genera, of which the species are all foreign to Europe; such as *HURO*, which contains the black bass, or black perch, of the English inhabitants of the banks of the Huron; *ETELIS*, *NIPHON*, *ENOPLOSUS*, and *DIPLOPRION*. The species of the last two genera are remarkable as resembling *Chætodons* in their general form, rather than percoid fishes.

GENUS APOGON, Lacépède. Body short, and, in common with the opercles, furnished with large scales which are easily dislodged; dorsal fins very separate; a double dentated border on the pre-opercle.

The *Apogon rex Mullorum* of Cuvier (*Mullus imberbis*, Linn.) is a small Mediterranean species, of a red colour, with a black spot on each side of the tail. It measures about three inches in length. The foreign species seem chiefly confined to the Indian seas, at least they have not yet been observed in those of Africa or America. A few have been met with along the shores of New Holland, New Guinea, &c.

GENUS POMATOMUS, Risso. Resembles the preceding in the separation of its dorsals, and its deciduous scales; but the pre-opercle is simply striated, the opercle emarginate, and the eye enormously large.

The only known species is the *P. telescopium*, a fish of excessive rarity. According to Risso, it scarcely ever leaves the bottom of the deep sea. He is aware of only two specimens having been taken near Nice during a period of thirty years. It measures about twenty inches in length. The colours are brownish violet, with red and blue reflections, the fins being brownish black. Whether the prodigious dimensions of its eyes are in any way connected with the depth and consequent darkness of its abode, is a point which we have not at present any means to determine.

b. *Some long and pointed teeth mixed with the close-set kind.*

GENUS AMBASSIS, Commerson. Resembles *Apogon* in form; the pre-opercle has a double dentation towards the base, and the opercle terminates in a point; but the two dorsals are contiguous, and the anterior one is preceded by a spine.

A peculiarity in the intestinal canal, that is, the want of appendages to the pylorus, renders the present position of this genus in the system somewhat doubtful. The species are small fishes found in the fresh waters of India. One of them, *A. Commersonii*, Cuv. is abundant in a small lake in the island of Bourbon, where it is prepared as the Europeans do anchovies.

GENUS LUCIO-PERCA, Cuv. Margin of the pre-opercle with only a simple dentation, dorsal fins not approximate.

This genus receives its name from the supposed combination which certain of its species exhibit of the characters of the pike and perch,—that is, they possess the fins and banded markings of the latter, with the elongated head and body, and acute lengthened teeth, of the former. The best known species is the *L. sandra* of Cuvier (*Perca lucioperca* of Bloch), an excellent fish, found in the lakes and rivers of Germany and the east of Europe, but unknown in France, Italy, and England. It sometimes attains to the size of a large salmon. Its growth is remarkably rapid, and its flesh is said to be rich and agreeable. Great quantities, preserved by salt or smoke, are exported from Prussia and Silesia.

B. *Seven branchial rays; only one dorsal fin.*

This subdivision is divisible, like the preceding, according to the nature of the teeth, the spines and dentations of the opercles, and other characters.

a. *Teeth hooked or canine.*

GENUS SERRANUS, Cuv. Pre-opercle dentated, bony opercle terminated by one or more points.

This extensive genus has been recently partitioned into several minor groups. *SERRANUS* proper contains the *Perca scriba* of Linn.; so called on account of some peculiar markings in the cheeks, resembling written characters.¹ *ANTHIUS* is represented by *A. sacer* of Bloch, a beautiful fish of the Mediterranean, of a ruby-red colour, changing into gold and silver, with yellow bands upon the cheeks. The third ray of the dorsal fin is greatly elevated, and the ventrals are much prolonged. This fish appears to have been known to ancient writers, and was regarded as sacred by the divers for marine productions, from the fond belief that no dangerous species would approach its haunts. When an individual happen-

¹ The smooth *Serranus* (*S. cabrilla*, Cuv.; *Perca channus*, Couch) has been described as a British species. Mr Couch regards it as a common fish, well known to the Cornish fishermen. He mentions (*Magazine of Nat. Hist.* vol. v. p. 19) that it keeps in the neighbourhood of rocks not far from land; and adds, as a singular fact, that the spasm which seizes it when taken never passes off. Hence it is found long after death in a state of rigidity and contortion, with the fins preternaturally erect. Both Cuvier and Cavolini have described this and other species of the genus as actual hermaphrodites,—one portion of each lobe of roe consisting of true ova, the other having every appearance of a perfect milt.

ed unfortunately to be caught by the fisherman's hook. it was supposed that its companions immediately severed the line by means of their sharp spines. MERRUS of Cuv. contains the *Perca gigas* of Gmelin, a species which sometimes attains to the weight of sixty pounds.¹ This subdivision of the genus *Serranus* contains a great amount of species. The only other which we shall here mention is that which we have shown in Plate CCXCVIII. fig. 4, under the name of *Serranus altivelis*, which is chiefly remarkable for the great size of the posterior portion of the dorsal fin. It occurs in the seas around Java.

GENUS PLECTROPOMA, Cuv. Differs from *Serranus* chiefly in the more or less numerous dentations of the inferior margin of the pre-opercle, being directed obliquely forward,—recalling in some measure the teeth of the rowel of a spur. All the species are foreign to Europe; and the same observation applies to the genus *DIACOPE*, the characters of which we shall not here detail.

GENUS MESOPRION, Cuv. Agrees with *Serranus* in its teeth, fins, and dentated pre-opercle, but differs in its opercle being terminated by an obtuse angle, not spinous.

The species are remarkable for the varied richness and lustre of their colours. They inhabit both the eastern and western seas, but occur chiefly in those of India, China, and Japan, concealing themselves in the hollows of rocks, and leaving their sombre haunts only during fine weather, to prey on the delicate Mollusca with which those waters swarm. Many of the species are large, and excellent as articles of food. *M. vivanus* attains the weight of forty pounds. We have figured, on Plate CCXCVIII. fig. 5, an American species of great beauty, described by Cuvier under the name of *M. unnotatus*. The back and upper portion of the head and cheeks are of rich steel blue, the lower part of the cheeks and sides of a fine rose colour, the abdomen silvery. The entire body is coursed by many bands of a golden hue, irregular and disconnected on the dorsal surface. The dorsal fin is rose-colour, with three yellow bands; the other fins are gamboge yellow. This species seldom much exceeds a foot in length.

b. Teeth fine, and closely set.

GENUS ACERINA, Cuv. Distinguished by cavities or depressions in the bones of the head, and by the opercle and pre-opercle having only small spines, without dentations.

We shall here name only the *Acerina vulgaris* (*Perca cernua*, Linn.), a British species, commonly called the ruffe, much esteemed for the delicacy of its flesh. Mr Yarrell informs us that it is common to almost all the canals and rivers of England, particularly the Thames, the Isis, and the Cam. Though said to be unknown in Spain, Italy, and Greece, it occurs pretty generally over the colder portion of the European continent, preferring slow, shaded streams, and a gravelly bottom.²

It is angled for with a small red worm, and being gregarious, six or eight dozen may sometimes be taken at a single stand.

GENUS RYPTICUS, Cuv. Small spines on the opercles; scales likewise small, and concealed, like those of Grammistes, beneath a thick epidermis. The genus, however, is well distinguished from the latter by the single dorsal fin.

The species have been named *Savonniers* by the French, in consequence of their soft and soapy surface, which feels as if it had been lubricated by some unctuous matter.

GENUS POLYPRION, Cuv. In addition to spines on the opercle, and dentations on the pre-opercle, the former is furnished with a rough bifurcated crest, and the bones of the head generally are marked by asperities.

P. cernium is an enormous fish, extremely common in the Mediterranean, but very indistinctly characterised or understood before the time of Cuvier and his able coadjutor M. Valenciennes. It attains the length of five or six feet, and sometimes weighs a hundred pounds. The flesh is white, tender, and well tasted. It is frequent, according to Risso, near Nice, where it delights in rocky bottoms, and is occasionally captured at the vast depth of three thousand feet.

Cuvier here places the singular genus *PENTACEROS*, of which the sole species, bearing some resemblance in its general aspect to the *Ostracion auritus* of Shaw, was brought to Holland by M. Horstock. We shall here likewise merely name the genera *CENTROPRISTIS* and *GRISTES* of Cuvier, the former containing the *Black Harry* of the Americans, an excellent fish, common near New York,—the latter, the species called *grouler* in the United States.

The ancient unrestricted genus *PERCA*, as defined by Artedi and Linnæus, terminates in this place. But there remains a large assemblage of allied species referrible to various distinct genera, though still pertaining to the great family of *PERCIDÆ*.

C. With less than seven branchial rays.

a. With a single dorsal fin, and canine teeth mingled with the others.

In this subdivision we place the genus *CIRRHITES* alone. The species are from the Indian seas, and have only six branchial rays.

b. With a single dorsal fin, and small close-set teeth.

Here are classed the genera *CHIRONEMUS*, *CENTRARCHIUS*, and *POMOTIS*. To the last belongs the *P. vulgaris*, Cuv. (*Labrus auritus*, Linn.), called pond-perch in New York. It is frequent in mill-dams and other tranquil waters, and is often angled for in America, both for pleasure and profit. According to Dr Richardson, it is called *sun-fish* around Lake Huron. See Plate CCXCVIII. fig. 6. Of the genus *PRIACANTHUS* we shall merely observe, that the species are peculiar to the seas of hot climates. The genus *DULES* resembles *Centropristis* already described, except that it possesses only seven branchial rays. *D. rupestris* bears resemblance to a carp, and is found in the fresh waters of the islands of Bourbon and the Mauritius, where it is highly esteemed for the excellence of its flavour. We have figured one of the most remarkable of the genus (Plate CCXCVIII. fig. 7), named *Dules auriga* by Cuvier, on account of the long whip-like form assumed by the third spine of the dorsal fin. It was brought from Brazil by M. Delalande.

We shall conclude this subdivision by a brief notice of the genera *THERAPON*, *DATNIA*, *PELATES*, and *HELOTES*. It has been observed that these constitute a group, formed, as it were, to make naturalists despair, by showing how nature laughs at what we deem characteristic combinations. The genera above named, possessing a multitude of mutual relations, as well interior as external, sufficient to forbid their distant separation, and bearing a great resemblance to the entire percoid family, at the same time combine species furnished with palatine teeth,

¹ It is synonymous with *Perca robusta* of Mr Couch, made known by that gentleman as a British species, from a single specimen taken with a line. (See *Magazine of Natural History*, vol. v. p. 21.)

² *History of British Fishes*, p. 18.

Acanthop-
terygii.
Percidæ.

along with other species which seem to be constantly deprived of these organs. They also possess close-set teeth in the jaws, and dentations on the sub-orbital, the pre-opercle, and not unfrequently on the shoulder bone; none has more than six branchial rays; no scales are visible on the cranium, muzzle, or maxillæ; the dorsal spines are folded back into a groove of the back; and the swimming bladder is constantly divided by a restriction into two distinct sacks, as in *Cyprinus*, *Choracinus*, and *Myripristis*,—a character somewhat remarkable in any group of the acanthopterygian order.

c. *With two dorsal fins.*¹

GENUS TRICHODON, Steller. Pre-opercle with several strong spines; opercle terminating in a flattened point; no scales; mouth almost vertically cleft.

Of this genus only one species has been yet discovered, the *T. Stelleri* of Cuv. It was found by the unfortunate Steller near Cape Cronock, and especially at the island of Unalashka. It inhabits sandy shores, in which it conceals itself on the ebbing of the tide, and is there collected by the natives with their hands. The females deposit their eggs in little hollows in the sand, and offer, it is said, an exception to the ordinary instinct of fishes, in attending to their young ones after they are hatched.

GENUS SILLAGO, Cuv. Head somewhat drawn to a point; mouth small; small crowded teeth on the jaws, and before the vomer; opercle terminating in a small spine; six branchial rays; dorsal fins contiguous;—the spines of the first slender, of the second long and low.

The species occur in the Indian Seas, and are held in high esteem for the delicate flavour and brightness of their flesh. The most noted species is the *peche madame* of Pondicherry (*S. domina*), of a brownish colour, and remarkable for the first ray of the dorsal fin being elongated to a filament as long as the body. Another species, called *Soring* by Russell (the *Sciæna malabarica* of Bloch), measures about a foot in length, and is of a fulvous colour. It is regarded as one of the best fishes in India.

D. *With more than seven branchial rays.*

The genera of this group, besides possessing eight branchial rays, are distinguished by this further peculiarity, otherwise unexampled among the acanthopterygian tribes, that they possess, besides the spine, seven soft rays, or even more, to each of the ventral fins. Many of the species are remarkable for their beauty.

GENUS HOLOCENTRUM, Artedi. Scales brilliant and dentated; opercle dentated and spinous; pre-opercle not only dentated, but furnished at its angle with a strong spine directed backwards.

The species of this genus are widely distributed, occurring in the warmer portions of both the Pacific and Atlantic Oceans. Few species are more remarkable, either for the magnificence of their integuments, or the strength of their spines. The lustre of their scales equals that of a mirror, and is rendered still more brilliant by bands of red and spots of brown variously distributed. They bear a close resemblance to each other. That which we have selected as an illustration (Plate CCXCVIII. fig. 8) is the *H. hastatum* of Cuvier, which exists in the Royal Museum of Paris. Its native country is unknown, although it is presumed to have been brought from the African

coast, and seems identical with specimens more recently collected by MM. Quoy and Gaymard at the Cape de Verd Islands.

Acanthop-
terygii.
Percidæ.

GENUS MYRIPRISTIS, Cuv. Resembles the preceding in splendour, form, and scales; but the pre-opercle has a double dentated margin, and wants the spine at the angle.

This genus is remarkable for its swimming bladder being divided into two portions, of which the anterior is bilobed and attached to the cranium in two places, where it is merely covered by a membrane, and which correspond to the cavities of the ears.

The genera BERYX and TRACHICHTYS are nearly allied to the preceding. The latter was originally characterised, and somewhat vaguely, by Dr Shaw, from a specimen received from the New Holland seas.

All the percoid fishes to which we have hitherto alluded are characterised by having their ventral fins inserted beneath the pectorals. But in several genera these important organs are otherwise placed. Thus, in the ensuing group, their position is in advance of the pectorals, that is, upon the throat. They are hence called

JUGULAR PERCIDÆ.

GENUS TRACHINUS, Linn. Head compressed; eyes approximate; mouth oblique; first dorsal very short, the second very long; pectorals large; opercle furnished with a strong spine.

Several of the species occur in the European seas, and two species, known in our own country as the greater and lesser weevers (*T. major* and *draco*), occur occasionally on the English coasts. They remain concealed in the sand, and the wounds inflicted by their spines are not only painful, but dangerous.

“That the greater weever,” observes Mr Yarrell, “prefers deep water, that it lives constantly near the bottom, that it is tenacious of life when caught, and that its flesh is excellent, are four points that have been already noticed; but this subject, in reference to fishes generally, may be farther illustrated. It may be considered as a law, that those fish that swim near the surface of the water have a high standard of respiration, a low degree of muscular irritability, great necessity for oxygen, die soon, almost immediately, when taken out of water, and have flesh prone to rapid decomposition. On the contrary, those fish that live near the bottom of the water have a low standard of respiration, a high degree of muscular irritability, and less necessity for oxygen; they sustain life long after they are taken out of the water, and their flesh remains good for several days. The carp, the tench, the various flat fish, and the eel, are seen gaping and writhing on the stalls of the fishmongers for hours in succession; but no one sees any symptom of motion in the mackerel, the salmon, the trout, or the herring, unless present at the capture. These four last named, and many others of the same habits, to be eaten in the greatest perfection, should be prepared for table the same day they are caught;² but the turbot, delicate as it is, may be kept till the second day with advantage, and even longer without injury; and fishmongers generally are well aware of the circumstance, that fish from deep water have the muscle more dense in structure,—in their language, more firm to the touch,—that they are

¹ In the indication of this group in the *Règne Animal*, t. ii. p. 149, there seems to be a typographical error where the words “à moins des six rayons branchiaux” are used, instead of *sept*. The mistake has been copied as a matter of course into all the English and American translations.

² The chub swims near the top of the water, and is caught with a fly, a moth, or a grasshopper, upon the surface; and Isaac Walton says, “But take this rule with you—that a chub newly taken and newly dressed is so much better than a chub of a day’s keeping after he is dead, that I can compare him to nothing so fitly as to cherries newly gathered from a tree, and others that have been bruised and lain a day or two in water.”

Acanthop- of finer flavour, and will keep longer, than fish drawn from
terygii. shallow water.
Percidæ.

“ The law referred to has its origin in the principles of organization ; and though it would be difficult for the anatomist to demonstrate those deviations in structure between the trout and the tench which give rise to these distinctions and their effects, it is only necessary to make the point of comparison wider to be assured of the fact.

“ Between a fish with a true bony skeleton, the highest in organization among fishes, and the lamprey, the lowest, the differences are most obvious. If we for a moment consider the lamprey, which is the lowest in organization of the vertebrated animals, with only a rudimentary vertebral column, as the supposed centre of zoological structure, and look from thence up and down the scale of organization, we on the extreme on one side arrive at man, to whom division of his substance would be destruction ; but on the other we come to the polype, the division of which gives rise to new animals, each possessing attributes, not only equal to each other, but equal also to the animal of which they previously formed but a small part.”¹ The species represented in our accompanying illustration (see Plate CCXCVIII. fig. 9) is *T. radiatus*, well known in the Mediterranean.

The Trachini of exotic regions, if such exist, are unknown. They are in some measure represented there by the genus PERCIS of Bloch and Schneider, which is found in the Indian, African, and New Holland seas.

The genus PINGUIFES, of a heavy form, is distinguished by its strong conical teeth ; its fleshy lips, and teeth upon the palate ; and by its thick ventrals. The only known species is from Brazil. The genus PERCOPHIS, on the contrary, is much elongated in its shape (combining, as it were, that of the perch and serpent,—from whence the name) ; some of the teeth are long and pointed, and the extremity of the lower jaw projects. The sole species is a rare and remarkable fish from Rio Janeiro, discovered by the French naturalists attached to Freycinet's expedition.

GENUS URANOSCOPUS, Linn. Eyes placed on the upper surface of a nearly cubical-shaped head ; mouth vertically cleft ; pre-opercle crenate towards its base ; a strong spine at each shoulder ; gills with only six rays.

In the interior of the mouth of this remarkable genus, and in front of the tongue, there is a long and narrow shred, which they can exert at pleasure, and which it is said they use while lying concealed in the mud, to attract their prey, consisting of the smaller fishes. Another singularity in their structure consists in the immense size of the gall-bladder, a fact well known to ancient observers. In some of the species the first dorsal, which is small and spinous, is separated from the second, which is soft and long. Such is *U. scaber*, a Mediterranean species, not unfrequently used as food, although of a most ugly and repelling aspect. In others the dorsal is single, and its spinous and softer parts continuous. Such is *U. inermis*, the species represented in Plate CCXCVIII. fig. 10, which attains to the length of a couple of feet, and is native to the coast of Coromandel. It dwells in the sand, and the Indian fishers allege, what is no doubt a gross exaggeration, that it sometimes penetrates to a depth of twenty feet.

In the third principal division of the percoid family the ventral fins are inserted behind the pectorals. They are hence named

ABDOMINAL PERCIDÆ.

GENUS POLYNEMUS, Linn. Several of the inferior rays of the pectorals free, and forming so many filaments ; ven-

trals not greatly posterior to the pectorals ; pelvis still suspended to the bones of the shoulder.

The species are allied to the Percidæ in general by the close set teeth upon their jaws, vomer, and palate ; but they possess the arched or convex snout, and the scaly vertical fins, which distinguish so many of the Sciænidæ. Their two dorsals are distant ; their pre-opercle dentated, and their mouths greatly cleft. They appear to inhabit the seas of all warm countries. *P. longifilis* of Cuv. (*P. paradiseus* and *quinquarius*, Linn.) is the noted mango-fish of India, so called from its fine yellow colour. According to Russel and Hamilton Buchanan, it is the most delicious of all the species eaten in Bengal. It is fished for all the year round, at the mouths of rivers, where the waters are saline. It ascends to some distance about spawning time in spring, but not beyond the influence of the tide. When in prime condition, the mango-fish, though only a few inches long, sells so high as a rupee. The eggs are also much esteemed. The colours of this species, like those of other fishes, seem to vary greatly, probably in relation to the condition of individuals, or the season of the year. M. Dussumier describes it as of a citron yellow, with the fins and filaments of a beautiful orange. Buchanan states that the greater number are silvery, with reflections of gold and purple, and a greenish tint upon the back ; the fins being then yellow, and the upper parts spotted with black. The same author names the silvery mango-fish *P. risua*, and the yellow ones *P. aureus* ; but he hesitates to make them distinct species, and rather opines that the fine colour is the result of season, and that it continues only during spawning time. This view of the subject is well confirmed by the fact, that the high-coloured specimens sent to Europe by M. Dussumier were full either of roe or milt, and is moreover in exact conformity with the observations of all practical anglers and Ichthyologists in relation to the species of our own country. We here figure (Plate CCXCVIII. fig. 11) a recently-discovered species, received by Baron Cuvier from Senegal. It is named *P. quadrifilis*, having only four free rays on the pectoral fins.

In the ensuing genera of the abdominal Percidæ, the ventrals are placed farther back, and the pelvis no longer adheres to the bones of the shoulder.

GENUS SPHYRÆNA, Bloch and Sch. Form elongated ; two distant dorsals ; head oblong, with the lower jaw forming a projecting point beyond the upper one ; a portion of the teeth large, pointed, and cutting ; opercle without spines ; pre-opercle without dentations ; seven branchial rays ; numerous appendages to the pylorus.

These fish were formerly classed with the pikes ; and the Italians still name them *Lucii marini*, on account of their strong and pointed teeth. The Mediterranean species (*S. vulgaris*, Cuv. ; *Esox sphyraena*, Linn.) attains to the length of three feet. *S. picuda*, from the coast of Brazil, is extremely similar. This fish, though used as an article of food, is occasionally poisonous. M. Poey alleges that the malady produced by eating it is sometimes mortal ; but he adds that it is easy to distinguish the dangerous individuals beforehand, by a peculiar blackness at the base of their teeth. Another species (*S. barracuda*, Cuv. ; *Esox barracud*, Shaw), which likewise occurs along the Brazilian shores, and among the Antilles, is said to be extremely formidable, on account of its ferocious habits. It is among the number of those marine monsters of which Rochefort speaks in his *Histoire des Antilles*, as greedy of human flesh. He states it to attain the length of seven or eight feet, and that it darts with fury upon any man whom it perceives in the water.

Acanthop-
terygii.
Percidæ.

¹ *British Fishes*, p. 22.

Acanthop-
terygii.
Percidæ.

The wounds of its teeth are said to be mortal. Dutertre attributes to it the same great size and malign qualities, and regards it as more dangerous than the fiercest shark. Neither noise, nor any kind of threatening movement, has the slightest effect in producing intimidation; on the contrary, such signs of dislike only excite it to a greater readiness to seize upon its victim. It must be a most disagreeable creature.

GENUS MULLUS, Linn. Surface of the body and opercles covered by large deciduous scales; pre-opercle without dentations; mouth small, or but slightly cleft, and feebly toothed; dorsal fins distant from each other; a pair of barbles or appendages depending from the symphysis of the lower jaw.

This genus, although allied to the Percidæ by several anatomical and external details, is yet characterised by so many peculiarities of organization, that it might almost be regarded as forming of itself a special family. Cuvier, however, has placed it *à la suite* of the Percidæ, and we shall therefore follow that great authority in this as in the other portions of our ichthyological system. The genus Mullus is now divided into two.

1. MULLUS proper. Branchiæ with three rays; opercle spineless; no teeth to the upper jaw; two large plates of small teeth *en paré* on the vomer; no swimming bladder.

To this sub-genus belongs the famous red mullet (*M. barbatus*), Plate CCXCVIII. fig. 12, which, by reason both of its great personal beauty, and the exquisite flavour of its flesh, has for so many ages ministered to the degenerate and heartless luxury of man. It is very frequent in the Mediterranean, and also occurs occasionally along the outer and more northern coasts of Europe. It is brought occasionally to the London markets during the mackerel season; but it is doubtful whether Müller is not in error in assigning to it so northern a locality as Denmark. "The great and rich among the Romans were in the habit, according to Varro, of preserving the red mullet in artificial waters, as one of the most convincing proofs of their individual wealth. Cicero has ridiculed the senseless ostentation with which they exhibited fine specimens of this fish, domiciliated in their own ponds; but Seneca and Pliny have rendered their countrymen odious in the eyes of posterity, and of other nations, by relating the cruelty with which, in their disgusting orgies, they revelled over the dying mullet, while the bright red colour of its healthy state passed through various shades of purple, violet, blue, and white, as life gradually receded, till the convulsions of death put an end to the *pleasing* spectacle. They had these devoted fish enclosed in water in vessels with sides of crystal, over a slow fire, on their tables, and derived a fiend-like pleasure from the lingering sufferings of their victims as the increasing heat of the water gradually destroyed them, before the final operation of boiling had rendered them fit to gratify the refined taste of civilization. One cannot indeed read these revolting histories of old time without a blush at certain modern practices far too analogous with them: the sense of taste may, in the cases alluded to, be alone consulted; but the difference is nothing to the suffering animal, whether its torments gratify one or more of the evil passions of its tormentors. The skinning of eels, and the boiling of live crustacea, would be as disgusting as the gradual boiling of a mullet, did not, in this as in many other cases, the practice of evil destroy the feeling of its iniquity. So extravagant was the folly of the Romans with regard to this fish, that they often gave for them

immense prices. Martial mentions one of four pounds weight, which had cost 1300 sesterces; and it is said that the Emperor Tiberius sold one weighing nearly five pounds for 4000 sesterces. Asinius Celer, one of the consuls, is reported by Pliny to have paid 8000; and, according to Suetonius, 30,000 sesterces had been given for three mullets."¹

The surmulet, or striped mullet (*M. Surmuletus*, Linn.), is larger than the preceding, and measures about a foot in length. It is much more common as a British species than the preceding, being of frequent occurrence along the extended line of our southern coast, from Cornwall to Sussex; but becoming rarer as we proceed from thence northward by the eastern coast. It has been regarded as migratory, yet it appears in the shops of the London fish-mongers throughout the year, though in much greater plenty during May and June, at which time their colours are most vivid, and the fish, as food, is in the best condition. The striped red mullet spawns in spring, and the young are five inches long by the end of October.² The species is much more extensively distributed than the red mullet, and is not confined, as Baron Cuvier seems to suppose, to European coasts. It occurs not far to the south of New York, and has been found in much greater numbers along the southernmost coasts of South America.³ It has been supposed that to this species the larger specimens of mullet mentioned by the ancients are referrible. Pliny indeed states expressly that the large mullets were found especially in the Northern and Western Oceans.

2. UPENEUS, Cuv. Branchiæ with four rays; teeth on both jaws, but frequently none on the palate; opercle with a small spine; a swimming bladder.

The species of this sub-genus are native to the seas of India and America. That which we have selected for illustration (Plate CCXCVIII. fig. 13) is the *H. Vlamingii* of Cuvier. It was sent to Paris by MM. Quoy and Gaimard, and when opened its stomach was found filled with small crustacea.

We here terminate the family of PERCIDÆ, or perch-like fishes, and proceed to

FAMILY II.—BUCCÆ LORICATÆ, or MAILED CHEEKS.

There are a certain set of fishes which, in the totality of their structure, certainly approach the preceding family of the perches; but on which the singular aspect of their variously-armed heads bestows so peculiar a physiognomy, that they have always been classed together in special genera. As examples, we may mention the gurnards, father-lashers, and river bull-heads, belonging to *Trigla* and *Cottus*. The common character of all these fishes consists in the sub-orbital bone being more or less extended over the cheek, and articulating behind with the pre-opercle. The genus *Uranoscopus* alone of the preceding family exhibits some affinity to this form of structure; but still in that case, the sub-orbital, though very broad, is connected posteriorly, not with the opercle, but with the temporal bones. It is then from this peculiar extension and attachment of one or both of the sub-orbitals that the family of the *mailed cheeks* derives its name.

In the Linnæan system these fishes formed three genera, *Trigla*, *Cottus*, and *Scorpena*, groups which have been considerably subdivided by Cuvier, who has more-

Acanthop-
terygii.
Buccæ
Loricatæ.

¹ Griffith's *Animal Kingdom*, vol. x. p. 277.

² Yarrell's *British Fishes*, p. 27.

³ Griffith's *Animal Kingdom*, vol. x. p. 278.

Acanthop- over added to them a certain portion of the genus *Gasterosteus*, or stickle-back tribe. Acanthop-
terygii. it from gulls and other aquatic birds, render it an object terygii.
Buccæ of the highest interest to the unaccustomed landsman, somewhat wearied with the monotony of a sailor's life. Buccæ
Loricatæ. "It is by the extension of the pectoral rays and mem- Loricatæ.
brane that the fish is enabled to raise itself from its proper element to the regions of the air, though this is by no means a continual flight, for the utmost it can do is to describe an arch over the surface of the water extending to a distance of about 120 feet, and sufficiently elevated for the fish sometimes to fall on the deck of a large vessel. This power of flight or momentary suspension would be much greater if the pectoral membrane could preserve its humidity longer: this is soon evaporated in the heat of the tropics; and the membrane, as it becomes dry, loses its buoyant power, and the fish falls. They are sometimes so numerous as to afford much pleasure to the spectator by their repeated flights; and at particular times, especially on the approach of rough weather, in the night, numbers of them may be seen, by the phosphoric light they emit, marking their arched passages in apparent streams of fire."

GENUS TRIGLA, Linn. Here the family character is strongly marked. An enormous sub-orbital covers the entire cheek, and even articulates by means of an immovable suture with the pre-opercle, which in this way possesses no separate movement; the sides of the head are nearly vertical, producing a form approaching that of a cube or of a parallelopiped, and the bones are hard and granulated; the back bears two distinct dorsals, and beneath the pectorals are three free rays; in the interior we find about a dozen cæca, and a broad bilobed swimming bladder.

This extensive genus has been subdivided by modern writers.

TRIGLA proper contains the *gurnards* commonly so called. They have small close-set teeth on the maxillæ, and before the vomer; and their pectoral fins, though large, are incompetent to sustain them through the air. *T. cuculus*, Linn. (*T. pini* of Bloch), our red gurnard, is a voracious species, common in the European seas. *T. lyra*, named the piper, is another British species remarkable for the hissing sound which it produces when caught, by expelling air through its gills. It is a beautiful fish, of a bright red above, and silvery white below. *T. cuculus* of Bloch (*T. Blochii*, Yarrell) is another red gurnard, distinguishable by a black spot on the first dorsal fin. *T. lucerna* is a Mediterranean species, so named because it shines in the dark. *T. hirundo* is a British species, known as the sapphirine gurnard. Its pectoral fins are rich green and blue. The only other species we shall mention is the grey gurnard (*T. gurnardus*), Plate CCXCVIII. fig. 1. Its muzzle is bifurcated, with three spines on each side. It is easily taken with a hook, and is common in the British seas.

PRIONITES of Lacépède contains species analogous to those last named, but with pectorals so long as occasionally to sustain them in the air. Their precise character, however, consists in their having a band of small close-set teeth on each palatine.

PERISTEDION of Lac. is separated from Trigla proper, with still more correctness. The whole body is as it were cuirassed over by great hexagonal scales, forming longitudinal ridges; the muzzle is divided into two points, and bears branched barbles beneath; the mouth has no teeth. The only well-known species is the *T. cataphracta*, Linn. a Mediterranean fish, called *Malarmat* both at Marseilles and Genoa, probably by an antiphrase, as it is one of the most redoubtably armed of all the fishes of the European seas.

DACTYLOPTERUS of Lac., yet further removed from Trigla, contains certain (though not the whole) of those species known under the famous name of flying fishes.¹ Their sub-pectoral rays are much more numerous and extended, and instead of being free, as in the preceding groups, they are united by a membrane so as to form a supernumerary fin, longer than the fish itself, and capable of supporting it in the air.

The common Dactylopterus, or flying fish of the Mediterranean (*Trigla volitans*, Linn.), is a species too remarkable for its functions, so opposite to those of its class in general, not to have attracted from an early period the attention of mankind. It is extremely common in the Mediterranean, and has been mentioned by all the authors who have treated of the fishes of that inland sea. The ardour with which it is pursued by the dolphins and bonitos, the sudden effort which it makes to escape these predaceous creatures by vaulting into the air, the

new and probably unthought of dangers which there await it from gulls and other aquatic birds, render it an object of the highest interest to the unaccustomed landsman, somewhat wearied with the monotony of a sailor's life. "It is by the extension of the pectoral rays and membrane that the fish is enabled to raise itself from its proper element to the regions of the air, though this is by no means a continual flight, for the utmost it can do is to describe an arch over the surface of the water extending to a distance of about 120 feet, and sufficiently elevated for the fish sometimes to fall on the deck of a large vessel. This power of flight or momentary suspension would be much greater if the pectoral membrane could preserve its humidity longer: this is soon evaporated in the heat of the tropics; and the membrane, as it becomes dry, loses its buoyant power, and the fish falls. They are sometimes so numerous as to afford much pleasure to the spectator by their repeated flights; and at particular times, especially on the approach of rough weather, in the night, numbers of them may be seen, by the phosphoric light they emit, marking their arched passages in apparent streams of fire."

It is singular that the species to which we now allude (*D. volitans*), though so frequent in the Mediterranean, should be almost entirely unknown along the oceanic coasts of Europe. Still more singular is it, in relation to that exclusion, that it should at the same time be found across the Atlantic, and spreading not only along all the central and southern shores of the New World, but extending even as far north as the chilly waters of Newfoundland. The great Gulf Stream may however prove influential in the northern distribution of many western species.

We shall conclude this notice by observing, that the fish in question measures about a foot in length; it is brown above, reddish below, with blackish fins, variously spotted with blue. Its most formidable weapon of offence consists of the long and pointed spine of the opercle, which it can raise and render almost perpendicular to its body. With this organ it is easy to conceive that it may produce serious, or even dangerous wounds; and we therefore wonder the less that a poet like Oppian should have declared them mortal.

There seems to be only one other clearly ascertained species of the genus *Dactylopterus*. It is the *D. orientalis* of Cuvier, and occurs in the Indian seas.

GENUS COTTUS, Linn. Head broad and depressed, mailed, and variously armed by spines or tubercles; two dorsal fins; teeth in front of the vomer, but none on the palatines; six rays to the branchiæ, and only three or four to the ventral fins. The inferior rays of the pectorals, as in the weevers (genus *Trachinus*), are not branched; the cæcal appendages are less numerous than in *Trigla*, and the swimming bladder is wanting.

The fresh-water species of this genus have the head almost smooth, and only a single spine to the pre-opercle. Their first dorsal is very low. The most common is the river bull-head (*Cottus gobio*, Linn.), sometimes called the miller's thumb. It is a small dark-coloured fish, four or five inches in length, and frequent in most of the streams of Europe and the north of Asia. It usually lies concealed beneath stones, from whence it darts with great rapidity upon its prey. It is said to be extremely prolific; and the female, when with spawn, becomes so greatly enlarged, that her ovaries protrude like mammæ. The bull-head, like the salmon, has a reddish hue when boiled. It affords a good and wholesome food, much sought after by the mountain tribes of several countries; yet Pallas as-

¹ Others, for example, belong to *Exocoetus*, one of the genera of *Malacopterygii abdominales*, to be afterwards described.

² Griffith's *Animal Kingdom*, vol. x. p. 280.

Acanthop-
terygii.
Buccæ
Loricatæ.

sures us that in Russia no one will taste it, although the common people hang it around their necks as an amulet, under the impression that it acts as a preservative against attacks of tertian fever. We have represented in this work (Plate CCXCVIII. fig. 2) a salt-water species, *C. scorpius*, commonly called the *father-lasher*, and frequent around our rocky coasts. Under the English name of father-lasher, two species, however, seem to have been confounded.¹ There are many other species of the genus, one of which is extremely common in all the bays and gulfs of Greenland.

Under the generic name of *ASPIDOPHORUS*, several Cotti have been separated from the parent group. Their bodies are cuirassed by angular plates, and the teeth are wanting on the vomer. Such is a small fish common on our shores, and of which the membrane of the gills is garnished with fleshy filaments. It is the *C. cataphractus* of Linn., our common *Pogge*, or armed bull-head. See Plate CCXCIX. fig. 3.

We may here name three genera as intermediate between *Cottus* and *Scorpena*, viz. *HEMITRIPTERUS* (ibid. fig. 4), *HEMILEPIDOTUS*, and *PLATYCEPHALUS*. We cannot enter into any details regarding them.

GENUS SCORPENA, Linn. Head, as in *Cottus*, mailed and jagged, but compressed laterally; body covered with scales; seven rays to the branchiæ; a single dorsal fin.

These are small fishes of a repulsive aspect, to be almost inferred from the vulgar names bestowed upon them in most countries, such as scorpion, toad, sea-devil, &c. The species represented on the above Plate, fig. 5, was received from the Isle of France. Many others occur in the Indian seas, as well as in those of more northern countries.

The genus *SEBASTES* of Cuv. possesses most of the characters of *Scorpena*, although the head is less jagged and scaly. The species are widely dispersed through both the northern and southern seas. We have selected as an illustration (Plate CCXCIX. fig. 6) *S. variabilis*, which attains to the length of two feet, and occurs in great abundance in the seas about Kamtschatka and the Aleutian Isles, where it is used as food. To this genus belongs another northern species (*S. norvegicus*, Cuv.; the *sea-perch* of Pennant), occasionally found along the British shores, and known to the Shetlanders under the name of *Bergyllt*, or *Norway haddock*.²

The genus *PTEROIS* of Cuv. contains the *Scorpena volitans* of Gmelin and other authors, remarkable for its enormous pectoral fins, which resemble those of the flying fish, except that they are feebler, and, from being so deeply notched, incapable of aiding the fish in leaving its native element. Mr Bennet was assured by the fishermen of Ceylon, where the species is very common, that they had never seen it fly.

The genus *APISTUS*, Cuv., resembles *Scorpena* in its palatine teeth and dorsal fin; but the few rays of the pectorals are all branched. The distinguishing character, however, consists in the strong spine of the sub-orbitals, which on being projected from the cheek becomes a dangerous weapon; the more so, as in a state of repose it is scarcely perceptible. In fact, their generic name is derived from *απιστος*, *perfidious*. M. Ehrenberg has made us acquainted with a species from the Red Sea, which greatly resembles the Indian *Woorah-minoo* described by Russel. It measures about four inches in length, and is of a reddish colour on the back, and whitish on the sides and abdomen. This *Apistus* flies like a *Dactylopterus*. Ehrenberg observed it in the vicinity of Tor; and when-

ever the sea was agitated, several fell into his vessel. As Acanthop-
terygii.
Buccæ
Loricatæ.
it is the only flying fish of the Red Sea, and is extremely abundant along those desert coasts over which the Israelites so long wandered, he has conjectured that the food mentioned in Exodus, ch. xvi. ver. 13, and by us translated *quails*, was in reality the fish in question. It is named by the Arabs *Gherad el bahr*, a term which we understand to signify *sea locust*. The genus is rather numerous. We have figured (Plate CCXCIX. fig. 7) *Ap. marmoratus*, a species transmitted by Peron from Timor. It surpasses the others in size, as well as in the lustre and precision of its marbled markings.

GENUS AGRIOPUS. No sub-orbital spine; dorsal still higher than in the preceding genus, reaching as far forward as between the eyes; the nape of the neck elevated; muzzle narrowed; mouth small and slightly toothed; body without scales.

The fish called sea-horse (*see paard*) by the Dutch colonists at the Cape, and used by them as food, belongs to this genus. It is the *A. torvus* of Cuvier.

GENUS PELOR, Cuv. Dorsal undivided, and teeth on the palate, like *Scorpena*; body without scales; two free rays beneath the pectorals; anterior portion of the head appearing crushed; eyes approximate; dorsal spines very high, and almost free; sub-orbital spine wanting.

The fantastic shape and almost monstrous aspect of these fishes are alone sufficient to distinguish them from every other genus. It is scarcely possible by words alone to convey an idea of their extraordinary forms. They inhabit the Indian seas, and one of the most remarkable is *P. filamentorum*, a species from the Isle of France, discovered during Duperrey's expedition. It may be inferred to feed upon crustacea, as the remains of squillæ were found within its stomach.

The genus *SYNANCEIA* of Bloch and Schneider is quite as hideous as that of *Pelor*, and indeed surpasses all the *Scorpenæ* in ugliness. Their heads are rough, tuberculated, but not compressed, and frequently enveloped in a loose and fungous skin; their pectoral rays are all branched, their dorsals entire; they have no teeth either on the vomer or palatines.

S. horrida, as the title implies, exhibits by no means an inviting aspect. It is named *Ikan-swangi*, or sorcerer fish, by the Malays. *S. brachio* of Cuv. is the species called *ji-fi*, or *hideous*, by the Negroes of the Isle of France, who hold it in great abhorrence. In fact, nothing can be conceived more frightful. At first sight, no one would consider it a fish, but rather as a mass or unformed lump of corrupted jelly. "Totum corpus," says Commerson, "muco squalidum et quasi ulcerosum." Its head and members seem enveloped in a sack of thick, soft, spongy skin, warty and wrinkled like that of a leper, and irregularly blotched over with various tints of brown and grey. Sometimes it appears entirely black; but it is always gluey and disgusting to the touch. The little eyes are scarcely discernible in the large cavernous head. This species is said to possess great tenacity of life, and survives for a long time out of the water. The skin, in fact, forms a little ring like that of *Pelor*, in the upper part of the gills, above the point of the opercle, through which the fish can respire at pleasure, leaving the remainder of the cover closed, and the branchiæ consequently unexposed to desiccation. The inhabitants of the Isle of France regard it rather as a reptile than a fish; and they fear what they call its sting (that is, the wound inflicted by its spines) more than that of snakes or scorpions.

GENUS MONOCENTRIS, Bloch. Body short, thick, and

¹ See *Hist. Nat. des Poissons*, t. iv. pp. 160-165; and Yarrell's *British Fishes*, pp. 60-63.

² Fleming's *British Animals*, p. 212.

Acanthop-
terygii.
Buccæ
Loricatæ.

Acanthop-
terygii.
Sciænidae.

completely mailed with enormous angular scales, rough and carinated; dorsal fin represented by four or five thick spines; each ventral consisting of a single enormous spine, in the angle of which some small soft rays lie concealed; head large and mailed; front gibbous; mouth large; small and close-set teeth in the jaws and palatines, but none upon the vomer; eight branchial rays.

Of this remarkable genus there is only a single species known, a small fish of a silvery whiteness, measuring about six inches in length. It inhabits the seas of Japan. See Plate CCXCIX. fig. 8.

GENUS *GASTEROSTEUS*, Cuv. Cheeks mailed, but the head neither spined nor tuberculated, as in the preceding genera. The special characters consist in the freedom of the dorsal spines, which do not form a fin, and in the pelvis being united to larger humerals than usual, thus furnishing the abdomen with a kind of bony cuirass. The ventrals, placed posterior to the pectorals, are reduced almost to a single spine. There are only three branchial rays.

The species are small fishes familiarly known under the name of Stickle-backs (Scotice, *Benticles*), extremely common in all the fresh waters of Europe. Gesner indeed asserted that they did not occur in Switzerland; but the contrary has been long since ascertained. Our most common species is *G. aculeatus*, Linn. (Plate CCXCIX. fig. 9), under which name, however, it is supposed that more than a single kind has been confounded. It is an active and greedy little fish, extremely destructive of the fry of other species, and consequently injurious in ponds where these are sought to be preserved. Mr Henry Baker informs us that it will spring not less than a foot perpendicularly out of the water, and to a much greater distance in an oblique direction, when it desires to overcome any opposing obstacle. "It is scarcely to be conceived," he adds, "what damage these little fish do, and how greatly detrimental they are to the increase of all the fish in general among which they live; for it is with the utmost industry, sagacity, and greediness that they seek out and destroy all the young fry that come in their way, which are pursued with the utmost eagerness, and swallowed down without distinction, provided they are not too large; and in proof of this, I must assert that a bannstickle which I kept for some time, did, on the 4th of May, devour, in five hours' time, seventy-four young dace, which were about a quarter of an inch long, and of the thickness of a horse-hair. Two days after it swallowed sixty-two; and would, I am persuaded, have eat as many every day, could I have procured them for it." The stickle-back sometimes swarms in prodigious numbers. Pennant states, that at Spalding, in Lincolnshire, there are once in seven years amazing shoals, which appear in the Welland, coming up the river in the form of a vast column. This course is supposed to arise from the multitudes which have been washed out of the fens by the floods of several years, and which collect in deep holes, till, overcharged with numbers, they are obliged to attempt a change of place. The quantity may perhaps be conceived from the fact, that a man employed in collecting them gained for a considerable time four shillings a day by selling them at the rate of a halfpenny a bushel. *G. pungitius*, commonly called the smaller or ten-spined stickle-back, is the least of all our fresh-water fishes. In common, however, with a more truly marine species (*G. spinochia*, Linn., which forms a sub-genus), it is also found in the sea.¹

We shall here conclude our exposition of the family with mailed cheeks.

FAMILY III.—SCIÆNIDÆ.

This family is closely related to the Percidæ, and exhibits almost all the same combinations of external characters, especially the dentations of the pre-opercle, and the opercular spines; but the Sciænidæ have never any teeth either on the vomer or palatines; the bones of the face and cranium are generally cavernous, and the muzzle more or less gibbous; a form rarely observed among the Percidæ. The vertical fins are frequently somewhat scaly.

Even in its interior organization our present family bears a considerable resemblance to the perches; but there are greater variations, and especially a more complicated structure of the swimming bladder. In several species that organ is furnished with a multitude of branched appendages (See Plate CCXCVII. figs. 6, 7, 8); and although we cannot trace in it any connection with the exterior, yet when we consider that many of the Sciænidæ are more remarkable even than the gurnards for the production of extraordinary sounds, it is difficult to believe that the peculiar structure of the swimming bladder is not in some way connected with their utterance. The Sciænidæ are almost as numerous as the perches; they are characterised in a great measure by similar habits, and present the same advantages to the human race. They almost all afford excellent eating; of several, indeed, the flavour is exquisite; and a few are of great size. The famous *maigre*, for example (*S. aquila*, Cuv.), commonly weighs about sixty pounds, and sometimes attains to the length of six feet.

A. Two dorsal fins.

GENUS *SCIÆNA*, Cuv. Head gibbous, supported by cavernous bones; two dorsals, or one deeply emarginate, with its softer portion much longer than the spinous; a short anal fin; a dentated pre-opercle; an opercle terminated by points; seven branchial rays.

The species bear a great resemblance to perch, except that they want the teeth upon the palate. Their whole head is scaly, their swimming bladder frequently furnished with remarkable appendages, and the stony bones of the ear are larger than in most fishes. One of the most remarkable is the *maigre* above alluded to (*S. aquila*), called *Umbrina* by the Romans, and held in high esteem even at the present day. (Plate CCXCIX. fig. 10.) It is a rare fish on the outer coasts of Europe, and disappears almost entirely towards the north. The only example with which we are acquainted of its appearance in the northern parts of our own country is recorded by Dr Patrick Neill.² It was caught off Ugea in Northmavine, Shetland, in November 1819, and was first observed by the fishermen while endeavouring to escape from a seal. It measured five feet four inches in length, and when lifted into the boat, made its usual "purring sound." Other instances are mentioned by Mr Yarrell. It is, however, extremely common in many parts of the Mediterranean, especially along the Roman states. Paul Jovius mentions that many are taken there at the mouths of rivers, along with sturgeons. They swim in troops, and are said to utter at times a singular low bellowing beneath the waters. It is recorded that three fishermen, guided by this sound, dropt their net on one occasion so successfully as to secure twenty fine fish at a single throw. The noise may be heard at a depth of twenty fathoms, and is often very perceptible when the ear is placed upon the gunnel of the boat. Its tone seems to vary, as some have compared it to a dull buzzing, others to a sharp whistle. Some of the fishermen allege that the

¹ It appears that we now possess seven British species of stickle-back, of which the four-spined (*G. spinulosus*, Yarrell) was discovered by Dr James Stark in the neighbourhood of Edinburgh. He exhibited specimens to the Wernerian Nat. Hist. Society in 1831.

² *Edin. New Phil. Journ.* No. 1.

Acanthop-
terygii.
Sciænidae.

males alone are musical during spawning time, and that it is quite possible to capture them without any bait, merely by imitating this peculiar sound. One alluded to by Cuvier as having been entangled in a net spread along the shore at Dieppe, was at first found sleeping; but on being handled, it roused itself so suddenly, and with such violence, as to precipitate the fisherman into the water, and force him to call for assistance before he could become its master. High, though of course imaginary virtues, were formerly attributed to the stones which occur in the ear of this, as of other osseous fishes. They were worn on the neck, set in gold; and Belon says they were called *colic-stones*, being renowned for the cure, and even prevention, of that complaint. It was necessary, however, that they should be received as a gift,—such as were purchased being found to lose their virtue.

The species above mentioned belongs to the genus *SCIÆNA* proper of Cuvier, a subdivision characterised by the feebleness of the anal spines, and by the want of canine teeth and barbles.

Other subdivisions of the principal genus *SCIÆNA* are as follows:—*OTOLITHUS* and *ANCYLODON* are foreign groups (from India and America), which we shall merely name. *CORVINA* of Cuvier differs from *Sciæna* proper chiefly in the much greater strength of the second anal spine. An abundant species in the Mediterranean is the *C. nigra*, of a silvery brown colour, with the ventral and anal fins black. It occurs in salt marshes and the sea, but does not appear to ascend rivers. It is less esteemed than the maigre, but is not unfrequently sold for that fish in the Italian markets. *JOHNUS* of Bloch is closely allied to the preceding. We here figure as an example of that minor group, the *C. dentex* of Cuv., a species from St Domingo. (Plate CCXCIX. fig. 12.) Several of the fishes used as food in India belong to the genus *Johnius*. Their flesh is light, but not highly flavoured. They are called *whittings* by the English in Bengal. The species are tolerably numerous, and inhabit both seas and rivers. *UMBRINA* of Cuvier is distinguished from the other *Sciænæ* by bearing a barble on the symphysis of the lower jaw. (Ibid. fig. 11.) The species represented (*U. coroides*) is a native of Brazil. The bearded *Umbrina* (*U. vulgaris*, Cuv.), a species frequent on the coasts of France, Italy, and Spain, was captured in the river Eya in 1827, as recorded in the minute-book of the Linnæan Society. *POGONIAS*, Lacépède, resembles the preceding; but it is furnished with several barbles instead of one. The species are remarkable for their size, some of them weighing occasionally above a hundred pounds, and for the singular sounds uttered by them, and which have gained them the vulgar name of *drums*. Mr John White, an American lieutenant, who (in 1824) published a Voyage to the China Seas, relates, that being at the mouth of the river Cambodia, himself and crew were greatly astonished by certain extraordinary sounds, which were heard from around and beneath the vessel. They resembled a combination of the base of an organ, the sound of bells, and the guttural cries of a large frog, with certain tones, which the imagination might attribute to a gigantic harp. It might almost have been said that the vessel trembled at those uncertain sounds. For some time they increased, and finally formed a loud and universal chorus, the entire length of the vessel, and on either side. In proportion as they ascended the river the mysterious sounds diminished, and finally altogether ceased. The interpreter gave the information that they were produced by a troop of fishes of a flattened oval form, which possess the faculty of adhering firmly to various bodies by their mouths. A similar phenomenon was noticed by the illustrious Humboldt in the South Seas, although he was unable at the time to divine the cause. It would, as Cuvier has remarked, be an object of curious research to discover by what organ

these sounds are produced. We have already mentioned, that the majority of the *Sciænidae*, especially such as are the most remarkable for the utterance of the sounds in question, have large swimming bladders, furnished with strong muscles. In some species the organ is characterised by prolongations, more or less complicated, which even penetrate the intervals of the ribs. It must, however, be borne in mind that these swimming bladders have no communication with the intestinal canal, nor in general with any part of the exterior. The example of the genus here figured is *P. fasciatus* (*Labrus Grunniens* of Dr Mitchell), a North American species. (Plate CCXCIX. fig. 13.)

GENUS *ÈQUES*, Bloch. Recognisable by a compressed elongated body, raised at the shoulders, and finishing in a point towards the tail; the first dorsal is elevated, the second long and scaly.

All the known species are American. See Plate CCXCIX. fig. 14.

B. *A single dorsal fin.*

a. *Seven branchial rays.*

The genera of this subdivision are *HÆMULON*, *DIGRAMMA*, and *PRISTIPOMA*, foreign groups, of each of which we have figured an example. See Plate CCC. figs. 1, 2, 3.

b. *Less than seven branchial rays.*

This minor group is again subdivisible in accordance with the character of the lateral line. Those in which that part is continuous to the tail are the genera *LOBOTES* (Plate CCC. fig. 4), *CHEILODACTYLUS* (ibid. fig. 7), *SCOLOPSIDES* (ibid. fig. 6), and *LATILUS* (ibid. fig. 9). Those in which it is interrupted are *AMPHIPRION* (ibid. fig. 5), *PREMNAS* (ibid. fig. 8), *POMOCENTRUS* (ibid. fig. 11), *DASYLLUS*, *GLYPHISODON* (ibid. fig. 10), and *HELIASES*. All these last-named genera consist of small species, which, with few exceptions, are natives of the Indian seas, the shores of which they embellish by the splendour of their colours, which are in general extremely brilliant. They may be perceived swimming about incessantly, and with great vivacity, among the rocks, and in the watery pools left by the ebbing tide. Although for the most part eatable, none of the species furnishes an important article of consumption, on account of the smallness of their size, and their not occurring in numerous shoals.

FAMILY IV.—SPARIDÆ.

The genera of this family, like those of the *Sciænidae*, have the palate destitute of teeth, and in their general forms, as well as in several particulars of their organization, they bear a strong alliance to that family; but they have no scales upon the fins. Their muzzle is not gibbous, nor the bones of their head cavernous. There are no dentations to the pre-opercle, nor spines to the opercle. The pylorus is furnished with cæcal appendages. None of the species possesses more than six rays to the branchiæ. They are further divisible according to the form of their teeth.

GENUS *SARGUS*, Cuv. Cutting incisors in front of the jaws, almost similar to those of the human race.

The species in general feed on shells and the smaller crustacea, which they easily crush with their molar teeth. Certain kinds appear to devour fuci, at least Cuvier found the stomachs of some which came from the Red Sea, and of others from the Atlantic Ocean, filled with that marine vegetation. Many vague notices of the Sargi are contained in ancient authors. Ælian and Oppian inform us that the male is polygamous, and fights with great fury against his own sex for the possession of many females.

Acanthop-
terygii.
Sparidæ.

*Acanthop-
terygii.
Sparidae.* The same authors attribute to it a feeling still more extraordinary,—a lively passion for goats, which it exhibits by always swimming with great rapidity towards those animals, and indulging in playful gambols before them. So blind was this passion, that a fisherman (it was so alleged) might catch as many as he pleased by disguising himself with the skin and horns of a goat, and scattering in the water flour steeped in goats' broth. We have somewhere seen a doggerel rhyme in allusion to this strange and foundationless fancy (it may have been an attempted translation of an ancient epigram), in which it was expressed that the Sargus

Went courting she-goats on the grassy shore,
Horning those husbands who had horns before.

The best-known species inhabits the Mediterranean. It is the *S. Rondeletii* of Cuv. (Plate CCC. fig. 12.) The American shores produce several others, one of which (*S. oris*) is called the *sheep's-head* by the Americans. Dr Mitchell speaks in the most eulogistic terms of the superexcellence of its flesh, and of the high esteem in which it is held at the tables of New York. It yields in his opinion to few fishes, and is worthy of being served at the most sumptuous entertainments. The price varies from a dollar to a dollar and a half for a middle-sized individual, and above that size the price ranges even so high as from four to seven pounds sterling. They sometimes weigh from fourteen to fifteen pounds. The fishery of this species forms an object of importance along the coasts of the state of New York. It approaches those of Long Island in the hot season from the month of June till the middle of September, after which it seems to seek retirement in the deep abysses of the ocean. As they swim in troops, they may be advantageously fished for with the net, and many hundreds are sometimes taken at a single cast. With the great nets used at Rayner town, and the two islands, thousands are drawn ashore. They are immediately packed in ice, and despatched during the cool of the night to the markets of New York. It is difficult to take the *sheep's-head* with a line, because it contrives to snap the very hooks asunder with its cutting teeth.

GENUS CHRYSOPHRIS, Cuv. Round molars on the sides of the jaw, forming at least three rows on the upper one; a few conical or blunted teeth in front.

The species of this genus are numerous, and extended through many seas. Those of the Mediterranean are only two in number, and are called *Daurades* by the French, no doubt from the Latin *Aurata*, a term applied to them by ancient authors. The Greeks named them *Chrysophris*, which signifies golden eye-brow, in allusion to the brilliant spot of gold which the common species bears between its eyes. That the *Aurata* of the Latins was identical with the *Chrysophris* of the Greeks, may be inferred from a passage in Pliny, which is obviously borrowed from Aristotle, and where the former word is used as the translation of the latter. According to Columella, the *Aurata* was among the number of the fishes brought up by the Romans in their *vicaria*; and the inventor of these vivaria, one Sergius Orata, is supposed to have derived his surname from the fish in question. Ælian tells us that the *Chrysophris* is the most timid of all fishes, and that branches of poplars planted in the sand during a reflux so terrified a party of these fishes which were carried upwards by the flux, that in the succeeding reflux they did not dare to pass the poplars, but allowed themselves to be taken by the hand.

The only species we shall here notice is the *Chrysophris aurata* (Plate CCC. fig. 14), described under the name of *Gilt-head* by Pennant.¹ This fish seldom quits the vicinity of the shore, and grows extremely fat in the salt ponds. We owe to Duhamel whatever information we possess regarding its habits. The fishermen informed that author that it agitates the sand forcibly with its tail, so as to discover the shell-fish which may lie beneath concealed. It is extremely fond of mussels, and its near presence is sometimes ascertained by the noise which it makes while breaking their shells with its teeth. It greatly dreads cold, and many were observed to perish during the severe winter of 1766. The Gilt-head is a British species, but of extremely rare occurrence.

GENUS PAGRUS, Cuv. Differs from the preceding by having only two rows of small rounded molar teeth in each jaw; the front teeth are either like those of a wool card, or small and crowded.

We have figured the best-known species, *Pagrus vulgaris*, Cuv. (*Sp. pagrus*, Linn.), the braize or becker of English authors, which appears to be confined chiefly to the Mediterranean. (See Plate CCC. fig. 13.) Its synonyms seem confused and contradictory, and are greatly mingled in the works both of British and foreign authors with those of certain *Pagelli* and other *Sparidae*. Its history as a British species is obscure. Dr Fleming no doubt records it in his *British Animals*, p. 211; but as he indicates it by "a dark spot at the base of the pectorals," it is probable that his actual species was *Pagellus centrodonatus*, Cuv. synonymous with *Sparus orphus* of Linn. Mr Couch, however, observes that it appears on the Cornish coast in moderately deep water throughout the summer and autumn, and retires in winter and spring.²

GENUS PAGELLUS, Cuv. Teeth nearly resembling those of *Pagrus*, but the molars, equally in two rows, are smaller; the conical teeth in front are slender and more numerous; and the physiognomy is different in consequence of a more elongated muzzle.

Several species occur in the European seas. *P. erythrinus*, commonly called the Spanish Bream (Plate CCC. fig. 15), is very abundant in the Mediterranean, and even enters the Atlantic, advancing pretty far north. It is very rare along the British shores. The fish figured by Donovan (*British Fishes*, iv. pl. 89) as the *Sparus aurata* of Linn. (Pennant's Gilt-head) belongs to our present genus. It is the *Pagellus centrodonatus* just before referred to, which Pennant also erroneously regarded as synonymous with *Sparus pagrus* of Linn. It is by no means a rare British species, although usually concealed by our modern authors under some other name. It is the *sea-bream* of Couch and Montagu.

GENUS DENTEX, Cuv. Conical teeth even on the sides of the maxillæ, usually in a single row, and of which some of the anterior are lengthened into large hooks.

The *Dentex vulgaris*, a fish of a silvery hue, shaded into blue upon the back, with reddish pectoral fins, and sometimes attaining to the weight of twenty pounds, has occurred upon the Sussex coast. The specimen figured by Donovan, pl. 73, was obtained in Billingsgate market.

GENUS CANTHARIS, Cuv. Teeth small and closely set all round the jaws, the outer range being the strongest; body elevated and thick; muzzle short; jaws not protractile.

The species of this genus, of which four inhabit the European seas, are very voracious, and easily taken by hook and line. We may name as an example the fish called the black bream by Montagu³ (*Cantharus griseus*,

¹ The Gilt-head of Donovan and Turton is, however, another species, the *Pagellus centrodonatus*, Cuv.

² Linn. Trans. vol. xiv. p. 79.

³ Mem. of Wernerian Society, vol. ii. p. 451.

Acanthop-
terygii.
Menidæ.
Squammi-
pennes.

Cuv.; *Pagrus lineatus*, Fleming; *Sparus brama*, Linn.). Other species occur about the Cape of Good Hope, and in the Indian seas; but it does not appear that any have yet been observed along the American shores, or around the islands of the Atlantic.

The genus Boors,¹ with which we shall conclude our sketch of the Sparidæ, has its outer row of teeth of a trencbant or cutting form; the mouth small, and not at all protractile. Two species occur in the European seas, more particularly in the Mediterranean. They differ from most of their congeners in living entirely on marine plants, such as algæ and fuel of various kinds. In accordance with this vegetable diet, their intestinal canal is very long, though they have few appendages around the pylorus. They are celebrated for the beauty of their colours.

FAMILY V.—MENIDÆ.

The genera of this family differ from those of the preceding in their upper jaw being capable of projection and retraction, in consequence of the length of the intermaxillary pedicles, which withdraw between the orbits. Their body is scaly like that of *Sparus*, of which genus they formed a part, until their re-arrangement by Baron Cuvier.

As we have nothing of general interest to state regarding the fishes of this comparatively limited group, we shall merely refer, in relation to its general contents, to our *Systematic Table* (note to page 165), and proceed to

FAMILY VI.—SQUAMMIPENNES.

So called because the softer, and frequently also the spinous portions of the dorsal and anal fins are covered with scales, which as it were encrust them, and render their discrimination from the rest of the body by no means easy. This is the most obvious character of these fishes, of which the form is in general much compressed. The intestines are rather long, and the cæca numerous. This family was comprised by Linnæus in his genus CHÆTODON, so called from the long, slender, and hair-like character of the teeth; and the species in general are alike remarkable for their singular forms and splendid colours.

The seas of the torrid zone have indeed no cause to envy the productions of those famous lands, the shores of which they have so long bathed with their translucent waters. If the equatorial regions of Africa and America possess, among their feathered tribes, the brilliant soumangas, the lustrous humming birds, and the gorgeous chatters, the intermediate ocean and the Indian seas contain countless thousands of the finny race which surpass even these in splendour. The Chætodons, in particular, form a family on which nature has bestowed her ornaments with a most lavish hand. The deep purple of the iris, the paler richness of the rose, the azure blue of the "crystalline sky," the darkest velvet black,—these hues, and many more, are seen commingled with metallic lustre over the pearly surface of this resplendent group. The eye of man receives the greater pleasure from their contemplation, in as far as being of moderate size, and haunting habitually the rocky shores, at no great depth of water, they are seen to sport in the sunbeams, as if desirous to exhibit their splendid liveries to the greatest advantage in the blaze of day.

Tribe 1st. Teeth Hair-like.

GENUS CHÆTODON, Cuv. Body more or less elliptical,

the spinous and the softer rays continuing in a nearly uniform curve; muzzle more or less advanced; the preopercle sometimes finely dented.

The species resemble each other not only in the more essential characters just stated, but even in the distribution of their markings. The majority, for example, are characterised by a black vertical band, in which the eye is placed. In some we find several additional vertical bands parallel to the one mentioned; in others they are oblique or horizontal. Certain species are distinguished by a filament which results from the prolongation of one or more of the soft rays of the dorsal fin. The genus is very extensive, containing upwards of sixty species even in its restricted constitution. We must here confine ourselves to a slight notice of two or three of these. *Chætodon reticulatus*, Cuv. (Plate CCCI. fig. 1) is a beautiful example obtained by MM. Lesson and Garnot at Otaheité. Its sides are mailed or reticulated by a longitudinal series of scales. It measures about six inches in length, and four in height. *Ch. lunula*, Cuv. (ibid. fig. 2), occurs at the Isle of France. It is nearly of the same size as the preceding. A third species, of even more singular markings, is *Ch. Ehippium* of the same author (ibid. fig. 3). It was found at the Moluccas by M. Reinwardt—at Bolabola one of the Society Islands, by MM. Lesson and Garnot,—and appears, by a coloured drawing in the Banksian Library, to have likewise occurred at Otaheité during Cook's third voyage.

GENUS CHELMON, Cuv. Separated from Chætodon on account of the extraordinary form of the muzzle, which is long and slender, open only at the extremity, and formed by the inordinate horizontal prolongation of the intermaxillary bone above, and of the inferior jaw. These parts are united for two thirds of their length by a membrane, so that the mouth is nothing more than a small terminal cleft. The teeth are rather fine and closely set than hair-like. *Chelmon rostratus* (*Chat. rost.* Linn.) is the most anciently known. It is a small fish, measuring from six to eight inches in length, and is remarkable for the following peculiarity. It feeds on flies and other winged insects, and when it perceives one of these either hovering over the surface, or settled on a twig or blade of grass, it ejects against it with considerable force a drop of liquid from its tubular snout, so as to drive it into the water. In shooting at a sitting insect it generally approaches cautiously within a few feet before it explodes the water. Schlosser has described this curious device in the *Philosophical Transactions* for 1764, after Hummel, and it has since been confirmed by Reinwardt. It is even said to be an amusement of the Chinese in Java to keep this fish in confinement in a large vessel of water, with a view to observe its dexterity in the practice of this admirable instinct. They fasten a fly or other insect to the side of the vessel, when the Chelmon immediately bombards it with such precision as very rarely to miss the mark. In a state of nature it is said to inhabit both the coasts and rivers of Java. We are as yet acquainted with only one other species of this restricted genus. It is the *Ch. longirostris* of Broussonet, of which the reader will find an accurate representation on Plate CCCI. fig. 5. It is not known *de facto* to possess the same singular mode of capturing its prey as the preceding, but that it does so may be almost inferred from its similarity of structure.

GENUS HENOCHIUS, Cuv. Differs from Chætodon in the spines of the back, particularly the third and fourth, being greatly increased in length, and forming a filament sometimes double the length of the body.

Acanthop-
terygii.
Squammi-
pennes.

¹ The generic name is changed to Box in the *Hist. Nat. des Poissons*, t. vi. p. 346.

*Acanthop-
terygii.
Squammi-
pennes.* *H. macrolepidotus* is a large fish, celebrated in the East for the excellence of its flavour. It is called *Vlagman* by the Dutch colonists, in allusion to the long filament upon the back. They also name it *Tafel-visch*, on account of its frequent use as food. Ruysch asserts that at Amboyna no good dinner is ever served without it, and he compares its taste to that of the finest flounder. The specimens hitherto sent to Europe do not seem to exceed the length of ten inches; but the species must at times greatly exceed that size, if, as Renard and Valentyn assert, it weighs from twenty to twenty-five pounds. As an example of this extraordinary genus we have figured *Henochius monoceros*, a species recently transmitted from the Isle of France by MM. Quoy and Gaimard, Plate CCCI. fig. 4. The specimen represented does not measure above seven inches, and its height is almost equal to its length.

The genus *ZANCLUS* of Commerson is closely allied to the preceding, but the scaling is so much more delicate that the skin appears almost smooth to the naked eye. The external aspect is, if possible, still more extraordinary. We have here engraved *L. cornutus* of Cuv. (Plate CCCI. fig. 8), which, on account probably of its singular form and horned front, has become an object almost of superstitious reverence among the fishermen of the Moluccas. It is alleged, that when they happen to capture one of this species, they immediately salute it by certain genuflexions, and then cast it into the sea. It is, however, an excellent table fish, which attains a weight of fifteen pounds, and resembles the turbot in flavour. It is rather widely diffused, occurring both in the Indian seas and Pacific Ocean.

GENUS *EPIHIPPUS*, Cuv. Distinguished by a deep emargination between the spinous and softer portion of the dorsal fin; the former part has no scales, and can be folded into a groove on the back.

An American species (*E. gigas*) is remarkable for the great club-shaped enlargement of the first inter-spinal of the anal and dorsal fins, and by a similar enlargement of the crest of the cranium. A fish which may be referred to a subdivision of this genus, occurs among the fossils of Mount Bolca.¹

Baron Cuvier has remarked,² that among all the strange and fantastic fishes preserved in the representations of Ruysch, Renard, and Valentyn,³ and which have so long excited the mistrust of naturalists, none seems more likely to provoke that feeling than the species which these writers designate by the Malay name of *Shankharbauw*, or buffalo-fish; and yet it now turns out that none is more accordant with the truth of nature. Its sharp recurved horns, the protuberance above the head, the compressed and unequal spines, and the singular distribution of colour, —all exist in a species recently received from the Indian Archipelago. It has accordingly been named *TAURICHTHYS* by Cuvier,—the Greek translation of the Malay name. The species here figured is *T. varius*, which is from four to six inches long, with a height almost equal to its length. See Plate CCCI. fig. 7.

GENUS *HOLACANTHUS*, Lacép. A large spine at the

angle of the pre-opercle, the margins of which are usually dentated.

The species are remarkable for the great beauty and symmetrical distribution of their colours, and for their excellence as articles of food. They are numerous both in the Indian and American seas. One of the most celebrated for the splendour and singularity of its aspect, is that named the *Emperor of Japan* by the Dutch, *Chatodon Imperator* of Bloch, figured in many works. Its body is deep blue, traversed all over by about two and thirty narrow bands of orange yellow.⁴ The pectoral fins are black, and the entire tail bright yellow. It is a large fish of its kind, sometimes attaining the length of fifteen inches, and, as an article of food, is one of the most esteemed of all the Indian species, resembling our own much-prized salmon in flavour. Another and more recently discovered species is *H. semicirculatus*, Cuv. It occurs both at Timor and New Ireland. Its colours are white and blue, its length from four to five inches. The inhabitants of Waigiou call it *Mami*.

GENUS *PLATAX*, Cuv. Anterior to the brush-like teeth, a row of cutting teeth, each of which is divided into three points; body much compressed, and apparently prolonged into thick, greatly elevated, scaly, vertical fins, in the anterior edge of which a small number of spines lie concealed.

Almost all the known species occur either in the Indian or Pacific Oceans. One or two were found by Ruppell in the Red Sea. They are esteemed as food. Words can convey but a feeble idea of the anomalous form of these fishes, some of which, if we include the vertical fins, are more than twice as high as they are long. We here figure the *Chatodon teira* of Bloch, which is a true *Platax*, Plate CCCI. fig. 6. It was brought by M. Dussumier from the coast of Malabar. It is said to attain to the length of two feet, a great size for a fish of this genus, many of which measure only a few inches. *P. punctulatus*, indeed, may be regarded as one of the smallest of known fishes, as it is only an inch long. It occurs at Timor.

GENUS *PSSETTUS*, Commerson. Form resembling the preceding; but all the teeth are small and crowded, and the ventral fins are reduced to a single small spine, without soft rays.

The species are natives of the Indian seas. Their teeth are rather short and close than in the usual bristle-like form of our present tribe of *Squammpennes*, yet they cannot be arranged under tribe third, in as far as they want the teeth upon the palate. The *Chatodon rhombus* of Bloch and Schneider belongs to this genus. It was anciently represented by Seba (t. iii. pl. 26, fig. 21), and now bears the name of *Pssetus Sebae*. The species is extremely rare, and its native country was unknown, till in recent times a specimen was transmitted from the Senegal coast by M. Perottet. It measures six inches in length, and is considerably higher than long. See Plate CCCII. fig. 1.

Tribe 2d. With cutting teeth.

GENUS *PIMELEPTERUS*, Lacép. Distinguished from all other fishes by a single range of teeth borne upon a ho-

¹ *Ittiol. Veronese*, plate 5, fig. 2.

² The works alluded to above are the following:—1. The *Theatrum Animalium* of Henry Ruysch (son of the celebrated anatomist), two vols. in folio, Amsterd. 1713, which is in fact a third edition of Johnston's prior work of the same name, with the addition of the plates of fishes, to be afterwards noticed. 2. A Dutch work entitled *East India, Ancient and Modern*, in five vols. folio, Amsterd. 1724–26. The author was Francis Valentyn, a Protestant clergyman of Amboyna. 3. A *Collection of Figures of Fish, and other Marine Creatures*, published by Francis Renard, in one vol. folio, Amsterd. 1754. This *recueil* was formed about thirty years prior to its publication, and was engraved from a collection of native Indian drawings, which, under a necessarily extraordinary aspect, are now known to exhibit with accuracy many truly interesting species. The same series of drawings, or a corresponding copy, seems to have supplied the originals of both the other works just named.

⁴ Shaw describes this magnificent fish as of a "golden-yellow, longitudinally but somewhat obliquely striped with very numerous bright blue parallel rays." This seems in some measure the reverse of the above, but is accounted for by the equal proportion of the two colours, either of which may be regarded as the groundwork.

² *Hist. Nat. des Poissons*, t. vii. p. 146.

Acanthop-
terygii.
Squammi
pennes.

horizontal base or heel, on the anterior edge of which is a vertical cutting portion. The body is oblong, the head obtuse, and the fins rendered thick by means of the scales with which they are covered.

P. Boscii is a small Atlantic species, which measures about five inches in length. Bosc, by whom it was brought from the coast of Carolina, has seen it following vessels in the high seas, and assembling in troops around the stern, in order to seize upon whatever is thrown overboard. It is shy at seizing a hook, and is said to know how to carry off the bait without being captured. It is sought after as food by the French, though held in slight esteem by the natives of Britain.

The only other genus of this tribe is that named *DIPTERODON* by Lacépède.

Tribe 3d. Teeth either close-set or en carde on the jaws and palate.

GENUS *BRAMA*, Bloch and Schneider. Pertains to our present family, so far as concerns the scales which cover the vertical fins, which have only a small number of spiny rays concealed in their anterior margins; but the teeth are *en carde* on the jaws and palate, the profile elevated, the muzzle very short, the front descending vertically, the mouth almost vertical when closed. The scales reach as far as the maxillaries; there are seven rays to the gills; a low dorsal and anal fin, each commencing by a salient point; a short stomach, a small intestine, and only five cæca.

Of this genus there was known till recently only a single species, that of the Mediterranean, the *Sparus Raii* of Bloch.

It is only of late that its characters and history have been rendered in any way clear or satisfactory—a fact the more remarkable when we consider its large size, its singular form, its extreme abundance, and the exquisite flavour of its flesh. In spite of all these circumstances, most modern authors seem to have written regarding it as if they were blindfolded. Bloch regarded it as a northern fish, simply because so far back as 1681 a specimen was thrown ashore on our Yorkshire coast; and Lacépède describes it as an oceanic species. The individual above alluded to was described by Ray in his *Synopsis* (p. 115), under the title of *Brama marina cauda forcipata*. Pennant figures and describes it in his *British Zoology* (2d edition) by the name of *toothed Gilt-head*, and it seems indicated by Mr Couch (in *Linn. Trans.* xiv. 78) as a *Chatodon* seen off the coast of Cornwall. There is no doubt that its central dominion is in the Mediterranean, as it is extremely common along many coasts of that inland sea.¹ It is called *Rondanin* in the markets of Genoa. At the same time there is no doubt that it wanders occasionally as far north even as Denmark, and that many accidental specimens have been captured along both the British and Irish shores. Two other species have lately been discovered in the equatorial seas.

GENUS *TOXOTES*, Cuv. Body short and compressed; dorsal situate on the hinder part of the back, strongly spined, its softer portion, as well as the corresponding part of the anal, scaly; muzzle depressed, short; lower jaw more advanced than the upper; small close-set teeth in either jaw, on the vomer, the palatines, the pterygoids, and tongue; six branchial rays; very fine dentations on the inferior margin of the sub-orbital bone and preopercle. Stomach short and broad; twelve cæcal appendages upon the pylorus; swimming bladder large and thin.

The *Toxotes jaculator* (Plate CCCII. fig. 2) is a small Javanese species, measuring six or seven inches in length, remarkable for possessing the same faculty as that mentioned in our notice of *Chelmon rostratus*. When it perceives a fly or other insect upon an aquatic plant, it dexterously drives it into the water by a shower of drops. Cuvier received a specimen from Batavia, the stomach of which was entirely filled with ants. This species has been erroneously multiplied in systematic works. It is twice described by Shaw² under two different names (*Scarus Schlosseri* and *Labrus jaculator*), neither of which is the right one; and there is no doubt of its being identical with Hamilton Buchanan's *Coius chatereus*, a supposed new species from the Ganges.³ It seems pretty widely distributed throughout the Indian Archipelago, and is known to the Malays by the name of *Ikan-sumpit*.

Acanthop-
terygii.
Scomber-
ridæ.

FAMILY VII.—SCOMBERIDÆ.

One of the most useful to the human race of the entire class of fishes, whether we consider their agreeable flavour, their considerable size, or their inexhaustible productive powers. We may mention the mackerel, the tunny, and bonito, as familiar examples.

When considered isolately, these celebrated fishes are by no means difficult to characterise. The simple separation of the posterior of the second dorsal, and of those of the anal fin, would of itself suffice; but the species above named are the chiefs of a numerous series of genera and sub-genera, in which the more typical form gradually alters, and passes insensibly into others which do not exhibit either the character just mentioned, or almost any other by which the principal types are distinguished. Scales usually very small, causing the greater part of the skin to appear as if entirely smooth; opercular pieces without spines or dentations, and in general numerous cæca;—these are almost the only prevailing characters which can be assigned to the family, which at the same time exhibits a likeness in the aspect of its constituent groups which never leaves it. In short, it forms what botanists call a family by series or transition. The majority have the sides of the caudal extremity carinated, or armed with scales or shields, which are themselves carinated; or the terminal rays of the second dorsal or of the anal are free; or the spiny rays of that dorsal want their uniting membrane. Most frequently the caudal fin is of great size, and corresponding vigour. In the majority, also, the first spiny rays of the anal fin are separated from the others, and form, as it were, a small distinct fin by themselves. But none of these characters is common to the whole.

We may here group, as forming the **FIRST GREAT TRIBE**, those genera of which the *anterior dorsal fin is entire, but the terminal rays of the posterior one are detached or isolated, forming what may be called finlets or spurious fins (pinne spurie).*

GENUS *SCOMBER*, Cuv. The mackerels, properly so called, have a fusiform body covered by scales, uniformly small and smooth; sides of the tail not carinated, but merely raised into two small cutaneous crests; a vacant space between the first and second dorsal fin.

The common mackerel (*Sc. scombrus*) is one of the most beautiful of fishes, and too well known to require a

¹ Mr Yarrell, however, has brought together various instances of its occurrence along the British shores; and as it is mentioned by Nilsson in his *Prodromus* as occurring on the coast of Norway, and by Reinhardt as a Danish species, it rather appears that Baron Cuvier regarded *Ray's Bream* too exclusively as a Mediterranean species.

² *General Zoology*, vol. iv. part ii. pp. 398, 485.

³ *Fishes of the Ganges*, part 201, plate 14, fig. 34.

*Acanthop-
terygii.
Scombe-
ridæ.* minute description. The back is blue, crossed by many dark transverse bands, nearly straight in the males, but finely waved in the females. The sides and abdomen are of a silvery hue, glossed with brilliant tints of gold. The name is said to refer to the spotted appearance of the upper parts, and to be derived from the Latin *macularius*. We shall here avail ourselves of Mr Yarrell's history of this important species.

"The mackerel was supposed by Anderson, Duhamel, and others, to be a fish of passage, performing, like some birds, certain periodical migrations, and making long voyages from north to south at one season of the year, and the reverse at another. It does not appear to have been sufficiently considered, that, inhabiting a medium which varied but little either in its temperature or productions, locally, fishes are removed beyond the influence of the two principal causes which make a temporary change of situation necessary. Independently of the difficulty of tracing the course pursued through so vast an expanse of water, the order of the appearance of the fish at different places on the shores of the temperate and southern parts of Europe is the reverse of that which, according to their theory, ought to have happened. It is known that this fish is now taken, even on some parts of our own coast, in every month of the year. It is probable that the mackerel inhabits almost the whole of the European seas; and the law of nature which obliges them and many others to visit the shallower water of the shores at a particular season, appears to be one of those wise and bountiful provisions of the Creator, by which not only is the species perpetuated with the greatest certainty, but a large portion of the parent animals are thus brought within the reach of man, who, but for the action of this law, would be deprived of many of those species most valuable to him as food. For the mackerel dispersed over the immense surface of the deep, no effective fishery could be carried on; but, approaching the shore as they do from all directions, and roving along the coast collected in immense shoals, millions are caught, which yet form but a very small portion compared with the myriads that escape.

"This subject receives farther illustration from a freshwater fish, as stated in the Magazine of Natural History, vol. vii. p. 637: 'When the char spawn, they are seen in the shallow parts of the rocky lakes (in which only they are found), and some of the streams that run into them: they are then taken in abundance, but so soon as the spawning is over, they retire into the deepest parts of the lake, and are but rarely caught.'

"It may be observed farther, that as there is scarcely a month throughout the year in which the fishes of some one or more species are not brought within the reach of man by the operation of the imperative law of nature referred to, a constant succession of wholesome food is thus spread before him, which, in the first instance, costs him little beyond the exercise of his ingenuity and labour to obtain.

"On the coast of Ireland, the mackerel is taken from the county of Kerry in the west, along the southern shore, eastward to Cork and Waterford; from thence northward to Antrim, and north-west to Londonderry and Donegal. Dr Mc'Culloch says it visits some of the lochs of the Western Islands, but is not considered very abundant. On the Cornish coast this fish in some seasons occurs as early as the month of March, and appears to be pursuing a course from west to east. They are plentiful on the Devonshire coast, and swarm in West Bay about June. On the Hampshire and Sussex coast, particularly the latter, they arrive as early as March; and sometimes, as will be shown, even in February: and the earlier in the year the fishermen go to look for them, the farther from the shore do they seek for and find them. Duhamel says the mackerel

are caught earlier at Dunkirk than at Dieppe or Havre: upon our own eastern coast, however, the fishing is later. The fishermen of Lowestoffe and Yarmouth gain their great harvest from the mackerel in May and June. Mr Neill says they occur in the Forth at the end of summer; and Mr Low, in his *Fauna Orcadensis*, states that they do not make their appearance there till the last week in July or the first week in August.

"The mackerel spawns in June; and, according to Bloch, five hundred and forty thousand ova have been counted in one female. I have observed, by the mackerel sent to the London market from the shallow shores of Worthing and its vicinity, that these fish mature and deposit their roe earlier on that flat sandy shore than those caught in the deep water off Brighton. The young mackerel, which are called shiners, are from four to six inches long by the end of August. They are half grown by November; when they retire, says Mr Couch, 'to deep water, and are seen no more that winter: but the adult fishes never wholly quit the Cornish coast; and it is common to see some taken with lines in every month of the year.' Their principal food is probably the fry of other fish; and at Hastings the mackerel follow towards the shore a small species of *Clupea*, which is there called, in consequence, the mackerel mint. I have been unable hitherto to obtain any specimens of this small fish; but, from various descriptions, I think it is probably the young of the sprat. It is described as being about one inch long in July.

"The mackerel as feeders are voracious, and their growth is rapid. The ordinary length varies from fourteen to sixteen inches, and their weight is about two pounds each; but they are said to attain the length of twenty inches, with a proportionate increase in weight. The largest fish are not, however, considered the best for the table.

"As an article of food they are in great request; and those taken in the months of May and June are generally considered to be superior in flavour to those taken either earlier in spring, or in autumn. To be eaten in perfection, this fish should be very fresh. As it soon becomes unfit for food, some facilities in the way of sale have been afforded to the dealers in a commodity so perishable. Mackerel were first allowed to be cried through the streets of London on a Sunday in 1698, and the practice prevails to the present time.

"At our various fishing towns on the coast, the mackerel season is one of great bustle and activity. The frequent departures and arrivals of boats at this time form a lively contrast to the more ordinary routine of other periods; the high price obtained for the early cargoes, and the large return gained generally from the enormous numbers of this fish sometimes captured in a single night, being the inducement to great exertions. A few particulars from various sources may not be uninteresting.

"In May 1807, the first Brighton boat-load of mackerel sold at Billingsgate for forty guineas per hundred—seven shillings each, reckoning six score to a hundred; the highest price ever known at that market. The next boat-load produced but thirteen guineas per hundred. Mackerel were so plentiful at Dover in 1808 that they were sold sixty for a shilling. At Brighton, in June of the same year, the shoal of mackerel was so great, that one of the boats had the meshes of her nets so completely occupied by them, that it was impossible to drag them in; the fish and nets, therefore, in the end, sunk together, the fishermen thereby sustaining a loss of nearly sixty pounds, exclusive of what the cargo, could it have been got into the boat, would have produced. The success of the fishery in 1821 was beyond all precedent. The value of the catch of sixteen boats from Lowestoffe, on the 30th of June, amounted to L.5252; and it is supposed that there was no less an amount than L.14,000 altogether realised by the

*Acanthop-
terygii.
Scombe-
ridæ.*

Acanthop-
terygii.
Scombe-
ridæ.

owners and men concerned in the fishery of the Suffolk coast.¹ In March 1833, on a Sunday, four Hastings' boats brought on shore ten thousand eight hundred mackerel; and the next day two boats brought seven thousand fish. Early in the month of February 1834, one boat's crew from Hastings cleared L.100 by the fish caught in one night; and a large quantity of very fine mackerel appeared in the London market in the second week of the same month. They were cried through the streets of London three for a shilling on the 14th and 22d of March 1834, and had then been plentiful for a month. The boats engaged in fishing are usually attended by other fast-sailing vessels, which are sent away with the fish taken. From some situations these vessels sail away direct for the London market; at others they make for the nearest point from which they can obtain land-carriage for their fish. From Hastings and other fishing towns on the Sussex coast the fish are brought to London by vans, which travel up during the night.

"The most common mode of fishing for mackerel, and the way in which the greatest numbers are taken, is by drift-nets. The drift-net is twenty feet deep, by one hundred and twenty feet long; well corked at the top, but without lead at the bottom. They are made of small fine twine, which is tanned of a reddish-brown colour, to preserve it from the action of the sea-water; and it is thereby rendered much more durable. The size of the mesh is about two and a half inches, or rather larger. Twelve, fifteen, and sometimes eighteen of these nets are attached lengthways, by tying along a thick rope, called the drift-rope, and at the ends of each net, to each other. When arranged for depositing in the sea, a large buoy attached to the end of the drift-rope is thrown overboard, the vessel is put before the wind, and, as she sails along, the rope, with the nets thus attached, is passed over the stern into the water till the whole of the nets are run out. The net thus deposited hangs suspended in the water perpendicularly twenty feet deep from the drift-rope, and extending from three quarters of a mile to a mile, or even a mile and a half, depending on the number of nets belonging to the party or company engaged in fishing together. When the whole of the nets are thus handed out, the drift-rope is shifted from the stern to the bow of the vessel, and she rides by it as if at anchor. The benefit gained by the boat's hanging at the end of the drift-rope is, that the net is kept strained in a straight line, which, without this pull upon it, would not be the case. The nets are shot in the evening, and sometimes hauled once during the night, at others allowed to remain in the water all night. The fish roving in the dark through the water, hang in the meshes of the net, which are large enough to admit them beyond the gill-covers and pectoral fins, but not large enough to allow the thickest part of the body to pass through. In the morning early, preparations are made for hauling the nets. A capstan on the deck is manned, about which two turns of the drift-rope are taken. One man stands forward to untie the upper edge of each net from the drift-rope, which is called casting off the lashings; others hand in the net with the fish caught, to which one side of the vessel is devoted; the other side is occupied by the drift-rope, which is wound in by the men at the capstan. The whole of the net in, and the fish secured, the vessel runs back into harbour with her fish; or, depositing them on board

some other boat in company, that carries for the party to the nearest market, the fishing vessel remains at sea for the next night's operation."²

Acanthop-
terygii.
Scombe-
ridæ.

Another mode of fishing is with a hook and line, angled with a coarse rod, from a boat under rapid sail. A slice from the mackerel's own body affords an excellent bait, and even a piece of scarlet cloth or leather is often used with great success. The line is weighed down by a heavy plummet; and when the fish are numerous, two men will thus capture from 500 to 1000 in a single day. It is a singular fact, that the common mackerel has no swimming bladder, although that organ is found in several closely allied species. What necessity of nature, Cuvier asks, can require it in the one, and not in the other? What can have produced it? These are great problems, both in the study of final causes, and in the general philosophy of nature.

GENUS THYNNUS, Cuv. A kind of corselet round the thorax, formed by scales larger and coarser than those of the rest of the body; sides of the tail with a cartilaginous keel between the two crests above mentioned. The anterior dorsal is prolonged almost to the posterior one.

The tunny (*Th. vulgaris*, Cuv.; *Scomber thynnus*, Linn.), (Plate CCCII. fig. 3), is one of the largest fishes of the ocean.³ When it weighs only a hundred pounds, the Sardinians give it the name of *scampirro*, a diminutive derived from *Scomber*. When above that weight, and onwards to three hundred pounds, it is called *mezzo-tonno*, or half tunny. The larger individuals frequently weigh a thousand pounds; and Cetti asserts that old males are taken occasionally weighing eighteen hundred pounds.⁴ The fishery of the tunny dates from the most remote antiquity; and the city of Byzantium was more especially enriched by it. The shoals which entered the Bosphorus were said to meet near Chalcedon with a white rock, which so terrified them that they turned into the Gulf of Byzantium, now the port of Constantinople. It was, according to Cuvier, in consequence of this abundance of tunnies, that the gulf in question received the name of the *Golden Horn*; and the oracle of Apollo designated Chalcedon as the *City of the Blind*, because its founders did not perceive the inferiority of its site in relation to these valued fish. Gibbon, however, tells us, that "the curve which it describes might be compared to the horn of a stag, or, as it should seem, with more propriety, to that of an ox. The epithet *golden* was expressive of the riches which every wind wafted from the most distant countries into the secure and capacious port of Constantinople." The same prodigious quantities of the tunny are still seen there as in ancient times. According to Syllius, twenty vessels might be filled by a single cast of the net; and they may frequently be taken by the hand without the aid of nets. When ascending towards the port, they may be killed with stones; and even women take them in quantities, merely by suspending a large basket by a cord from the windows.⁵ The tunny fishery was of still more ancient practice in the West. The Phœnicians established it at a very early period on the coasts of Spain, both within and beyond the columns of Hercules. It is thus that we find the tunny on the Phœnician medals of Cadiz and Carteia. Its salted preparation was known to the Romans as an esteemed article, under the name of *Saltamentum Sardinum*.

The tunny fishery does not seem to be now carried on

¹ "In an interesting and useful sketch of the natural history of Yarmouth and its neighbourhood, by C. and J. Paget, it is stated at p. 16, that in 1823, one hundred and forty-two lasts of mackerel were taken there. A last is ten thousand."

² *British Fishes*, p. 121.

³ We may here note, in regard to the engraved illustrations of the present treatise, that we found it impossible to maintain a proportional size in our figures. Thus the *tunny*, a gigantic species, appears, upon the plate above referred to, as smaller than its neighbour *Toxotes jaculator*, which is scarcely more than half a foot long.

⁴ *Histoire Naturelle de Sardaigne*, t. iii. 134, 135.

⁵ *De Constantinop. Topographia*, in præf.

Acanthop-
terygii.
Scombe-
ridæ.

Acanthop-
terygii.
Scombe-
ridæ.

at Constantinople on a great or systematic scale, but is chiefly concentrated in the interior of the Mediterranean. The species sometimes wanders along the British shores; and a fine specimen, measuring nine feet in length, was killed in the beautiful Gairloch, opposite Greenock, in July 1831. It is preserved in the Andersonian Museum, Glasgow.

The fish known to navigators under the name of *Bonito* belongs to our present genus. It is the *Th. pelamys* of Cuv. and sometimes occurs along the British shores. It resembles the tunny in form, but is a great deal smaller, seldom exceeding the length of thirty inches. It is celebrated in the tropical seas for its eager pursuit of the flying fish. The bonito of the Mediterranean, however, be it remembered, belongs to the following genus.

GENUS *AUXIS*, Cuv. Corselet and pectoral fins as in *Thynnus*; but the dorsal fins distant, as in *Scomber*.

We here engrave (Plate CCCII. fig. 5) a species common in the Mediterranean, where it is called bonito, *Auxis vulgaris*, Cuv. It is of a fine blue colour above, with oblique blackish lines. The flesh is red and coarse. We have eaten it during a voyage to Genoa, in the course of which the vessel was followed by a flock for an entire day. We struck them with a small harpoon from the bowsprit. The species seldom exceeds six pounds.

In regard to the genus *PELAMYS* of Cuv.¹ we shall here merely state, that it is distinguished from the tunnies by its strong, separate, and pointed teeth. The vague name of bonito is likewise applied to one of the species, the *Scomber sarda* of Bloch, common in the Mediterranean. The genus *CYBIUM* has the body elongated, without corselet, the teeth large, compressed, cutting, in the form of lancets. On the palatines there are only the close-set kind of teeth. The species inhabit the warmer parts both of the Atlantic and Pacific Oceans, and some of them attain a great size. The genus *THYRSITES* differs from the preceding in having the anterior teeth longer than the others, as well as the palatines being furnished with pointed teeth.

The genus *GEMPYLUS* is allied in many respects to that last named, but it wants the teeth upon the palate, and the ventrals are almost imperceptible. See Plate CCCII. fig. 6, where we have represented *G. prometheus*, Cuv., a species discovered at St Helena, by Messrs Quoy and Gaimard.

We shall here briefly notice two genera which cannot be better placed than in succession to the preceding Scomberidæ. We allude to *LEPIDOPUS* and *TRICHIURUS*,² which resemble the two last-named groups in almost every thing, except that they entirely want the finlets, or false fins, and even the soft rays of the dorsal. There is merely a vestige of the ventral fins. It is a singular thing, as Cuvier has observed, that a fish so generally met with as the great *Lepidopus argyreus* of the European seas (there is no other species), so handsome, and so large, should have remained unknown to naturalists so recently as the end of the eighteenth century, and that it should have been afterwards successively described by various writers, under a new name, and by each in ignorance of the labours of his predecessor. If we figure to ourselves a large and broad riband of silver, swimming with a wavy motion through the water, and casting from it in its progress the most beautiful reflections of light, we may form some notion of the general aspect of this creature in its living state. Its length, as described by Montagu³ (under

the name of *Zipotheca tetradens*), was five feet six inches, with a depth at the gills of four inches and a half; it gradually decreased from the vent to the commencement of the anal fin, where it measured only two inches in depth; at the end of that fin the form was nearly round, and the diameter only half an inch. The weight, without the intestines, was about six pounds. Montagu's specimen was taken in Salcomb Harbour, on the coast of South Devon, on the 4th June 1808. It was swimming with astonishing velocity, *with its head above water*, going, as the fishermen said, "as swift as a bird," and was killed by the blow of an oar. It occurs occasionally on most of the European coasts; is more frequent in some parts of the Mediterranean; and has been captured as far south as the Cape of Good Hope. See our representation on Plate CCCII. fig. 4.

The other genus to which we have alluded, that of *TRICHIURUS*, Linn., resembles the preceding in its head and teeth, but it has not even a vestige of a ventral fin; the anal is replaced by a series of very small spines, which scarcely project above the skin, and the tail terminates in a filament or lengthened point, without any caudal fin. We here figure (Plate CCCII. fig. 8) an Indian species, named *Trichiurus savala* by Cuvier. We believe it is synonymous with *T. armatus* of Mr Gray's *Illustrations of Indian Zoology*. Some additional species are figured in Mr Griffith's valuable edition of the *Animal Kingdom*, and that called the silvery hair-tail, or blade fish (*T. lepturus*, Linn.), was some years ago cast ashore on the Moray Firth.⁴

Another group of Scomberidæ, or rather a branch of the first great tribe, contains the sword-fish, and a few other species, which modern Ichthyologists, anterior to the time of Cuvier, placed too much apart from each other, solely because some were possessed of ventral fins, while in others those parts were wanting, "différence," observes our author, "qui ne sert qu'à prouver de plus en plus le peu d'importance de ces nageoires pour un méthode naturelle."⁵ Their relationship to the tunnies and mackerels has been still less appreciated, although very obvious in the form of the tail, the structure of the intestines, the quality of the flesh, and even in the parasitical animals by which they are infested; but as they differ in wanting the false fins, all actual resemblances have been set aside, at least in regard to such as are destitute of ventral fins.

GENUS *XIPHIAS*, Linn. Pertains to the family Scomberidæ, and approaches the tunnies especially in the extreme smallness of the scales, the carination of the sides of the tail, the strength of the caudal fin, and the whole of the interior organization. The distinctive character consists in the lengthened beak or sword-like prolongation of the muzzle or upper jaw, which forms a powerful weapon of offence, and enables them to attack and overcome the largest marine animals. This beak is composed chiefly of the vomer and intermaxillaries, strengthened towards the base by the ethmoid, the frontals, and maxillaries. The branchiæ are not divided like the toothing of a comb, but formed each of two large parallel plates, of which the surface is reticulated. The rapidity of their course is excessive, the quality of their flesh excellent.

Such is a brief indication of the characters of the genus *Xiphias* of Linnaeus, which has been divided as follows, in more recent times.

Ist. Genus *XIPHIAS* proper, Cuv. No ventral fin.

¹ *Hist. Nat. des Poissons*, t. viii. p. 149. The genus *PELAMYS* corresponds to that named *SARDA* in the second edition of the *Règne Animal*, t. ii. p. 199.

² Both genera were formerly placed by Cuvier in the ensuing family *TÆNIOIDÆ*. (See *Règne Animal*, t. ii. p. 217.)

³ *Memoirs of the Wernerian Nat. Hist. Society*, vol. i. p. 82.

⁴ *Linn. Trans.* vol. xi. p. 200.

⁵ *Hist. Nat. des Poissons*, t. viii. p. 254.

Acanthop-
terygii.
Scomber-
ridæ.

The only known species seems to have received the same name from all nations. *Gladus*, *Epée*, *Dard*, *Pesce-spada*, *Schwerd-fish*, *Sword-fish*, and the Greek generic name of *Xiphias*, all indicate the formidable weapon with which the front is armed. So remarkable a creature in size and structure could indeed have scarcely remained unknown at any period. All ancient writers within whose province it could possibly fall, speak of it in such a manner as clearly to prove an intimate knowledge of its nature. They describe its offensive weapon, the blows which it inflicts, the dreadful combats which it sustains, the attacks which are made upon it, and the stratagems by which, in spite of its strength, it is lured to its destruction. Although, in relation to its European distribution, the Mediterranean may be said to be its chief dominion, yet the older individuals especially often enter the ocean, and astonish the natives of colder climes by spreading along the northern shores. It has been frequently captured on the British coasts. It even enters the Baltic, and has been seen near Lubeck, of an enormous size.¹ Pennant is doubtful of its occurrence as a North American species, although it is named as such by Catesby. It is not noticed by Dr Mitchell, in his description of the fishes of New York, and for this reason Baron Cuvier does not admit that it crosses the Atlantic. It is, however, fully described by Dr Smith, in his *Fishes of Massachusetts*; and the same writer assures us, on the authority of an old pilot, that the sword-fish is by no means uncommon off that portion of the American shore. It cannot, however, be traced far south in any part of the western world; whilst, like many of the Mediterranean species, it advances along the African coast as far as the Cape of Good Hope.

The fish now alluded to is the *Xiphias gladius*, Linn. (Plate CCCII. fig. 7.) Its horizontal snout is flat and cutting, like the blade of a sword. The sides of its tail are strongly carinated. It has but one dorsal fin, which rises both before and behind, but of which the middle portion in the adults becomes in some manner so worn away, that an appearance is at last presented of two dorsal fins. This will be perfectly understood by comparing the figure last referred to, with fig. 10 of the same plate, where we have represented the young of the present species.²

Sword-fish, though by no means uncommon, are seldom captured, owing to their extreme vigilance. Captain Beechey informs us, that while in the Pacific Ocean, near Easter Island, "as the line was hauling in, a large sword-fish bit at the tin case which contained our thermometer, but fortunately failed in carrying it off." Their mode of capture in the Mediterranean may be likened to whale fishing in miniature, and is said to be a very amusing and exciting sport. A watchman placed upon a mast, or standing on the summit of a neighbouring rock, gives warning by signal when he sees a fish approach. The fishermen then row towards it; and, being so skilful as frequently to strike the fish from a great distance, they throw a harpoon into it attached to a long line. An arduous struggle then commences, during which the aggressors are sometimes pulled about by the fish for many hours before they can get it into the boat.

We shall conclude by observing, that the sword-fish is not only one of the largest species of the European seas, attaining sometimes to a length of fifteen feet, but that it is also much esteemed as an article of diet. When young, especially, the flesh is white, firm, and of excellent flavour.

Acanthop-
terygii.
Scomber-
ridæ.

2d. Genus TETRAPTERUS, Rafinesque.³ Point of the muzzle shaped like a stiletto; ventrals consisting each of one unjointed slender bone; two small projecting crests, like those of the mackerel, at each side of the base of the caudal fin.

The sole European species is *T. belone* of the Italian author. It is a large Mediterranean species, of about six feet in length, and weighing from 150 to 200 pounds.

3d. Genus MAKAIRA, Lacép. Possesses the points of the two small caudal crests of the preceding genus, but it wants the ventral fins.

We shall merely mention as an example the *X. Makaira*, or short-snouted sword-fish of Shaw.⁴

4th. Genus HISTIOPHORUS, Lacép. Characterised by the beak and caudal crests of Tetrapterus, but the dorsal fin is so greatly elevated as to serve as a sail when swimming on the surface, and the ventrals are long, slender, and composed of two rays.

This genus contains that large and showy species (*H. indicus*, Plate CCCII. fig. 9) known to the Malays by the name of fan-fish, and called by the corresponding title of sail-fish by the Dutch. It sometimes attains to so great a size as to have been compared to a small whale. When swimming near the surface, its dorsal fin may be seen projecting, from the distance of a league at sea. Many years ago a letter was addressed to Sir Joseph Banks by the captain of an East Indiaman, containing an account of the astonishing strength occasionally exerted by this species. The bottom of the ship was pierced through by it in such a manner that the snout or sword was buried almost to its base, and the animal itself was killed by the violence of the blow. Accidents of a similar nature have also occurred with the common sword-fish; and it is the opinion of naturalists that both species mistake our wooden walls for the vast abdomen of some great cetaceous animal which they desire to encounter and destroy.

We here figure, under the name of *Histiophorus pulchellus*, a beautiful dwarf species taken by M. Raynaud on his return from the Cape to France in 1829. It measured only four inches in length, and possesses certain special characters, which lead to the conclusion that, notwithstanding its minute size, it ought not to be regarded as the young of any previously described species. See Plate CCCII. fig. 11.

We now enter upon a group of genera which form the SECOND GREAT TRIBE of Scomberidæ, and are characterised by having the *spiny rays of the back not continuous, but separate*.

The Scomberidæ, as has been already remarked, have the caudal fin in general very strong, although the other vertical fins are often extremely feeble. We have now noticed

¹ Captain Crow, in a work recently published, relates the following spectacle, witnessed during a voyage to Memel. "One morning, during a calm, when near the Hebrides, all hands were called up at three A. M. to witness a battle between several of the fish called thrashers, or fox-sharks (*Carcharias vulpes*), and some sword-fish on one side, and an enormous whale on the other. It was in the middle of summer, and the weather being clear, and the fish close to the vessel, we had a fine opportunity of witnessing the contest. As soon as the whale's back appeared above the water, the thrashers, springing several yards into the air, descended with great violence upon the object of their rancour, and inflicted upon him the most severe slaps with their long tails, the sound of which resembled the reports of muskets fired at a distance. The sword-fish, in their turn, attacked the distressed whale, stabbing from below; and thus beset on all sides, and wounded, when the poor creature appeared, the water around him was dyed with blood. In this manner they continued tormenting and wounding him for many hours, until we lost sight of him; and I have no doubt they in the end completed his destruction." (Quoted from Mr Yarrell's *British Fishes*, p. 144.)

² It was probably this disparity of the dorsal fin in different individuals that induced Dr Leach to apply the new name of *Xiphias Rondeletii* to the old species. (See *Wernerian Memoirs*, vol. ii. part i. p. 58.)

³ *Caratteri di alcuni nuovi generi, &c. della Sicilia*, p. 54.

⁴ *General Zoology*, vol. iv. part i. p. 104, pl. 16.

Acanthop-
terygii.
Scombe-
ridæ.

the genera of the first great tribe, in which the posterior portion of the second dorsal and of the anal fin possess no continuous membrane between its rays, which thus remain free and disconnected, under the name of finlets. But in the group which we are about to enter it is the anterior dorsal which wants the membrane, and of which the rays are consequently free, and capable of isolated movement. Certain species even conjoin with this character that of the preceding tribe, and have finlets behind, at the same time that they possess free rays upon their anterior portion.

GENUS NAUCRATES, Rafin. Dorsal spines free; body fusiform; a carina or keel on the sides of the tail, as in the tunny, and two free spines before the anal fin.

This genus contains *N. ductor*, the famous *pilot-fish* of navigators (*Gasterosteus ductor*, Linn.), so named from its habit of keeping company with ships at sea, and frequently swimming beneath their bows. It would seem, from early indications of a similar instinct, to be the *Pompilius* of the ancients, described as pointing out the way to dubious or embarrassed sailors, and as announcing the vicinity of land by its sudden disappearance. It was thus regarded as a sacred fish. The other story of its serving as a guide to the shark does not appear to have been transmitted to us from so remote a source. It is not mentioned even by the Ichthyologists of the sixteenth century; and Cuvier regards as the first allusion to it, that of Dutertre in his *Description of the Antilles*, printed in 1667. Since that period it has been carefully repeated by all voyagers and compilers; and Osbeck even makes it a subject of pious reflection on the wonderful ways of Providence. We are told by a greater than Osbeck that "they that go down to the sea in ships, that do business in great waters; these see the works of the Lord, and his wonders in the deep:" but the fact in the present instance seems reducible to this, that the pilot accompanies both ships and sharks, sometimes swimming before, sometimes behind, for the sake of preying upon whatever may be thrown over board in the one case, or left uneaten in the other. It is true that the shark never attacks it; but it is also true that the hawk does not attack the swallow; and in both instances the reason is the same; the pilot being too nimble for the unwieldy shark in the water, just as the feebler but more agile bird is too swift in its movements for *falco* in the air. It is thus that the apparent alliance of these dissimilar fishes may be explained even upon general principles, to say nothing of Bosc's observation, who assures us that he has seen hundreds of pilot-fish, that

they always keep at a respectful distance from the shark, Acanthop-
terygii.
Scombe-
ridæ.
and swim about swiftly in different directions, that they may more certainly avoid it. If any food be thrown over board, the pilot stops to seize it, and abandons both the shark and vessel. Geoffroy no doubt tells a story of two pilot-fish having been seen to take a great deal of trouble, swimming to and fro, in order to conduct a shark towards a baited hook; but admitting the truth of the details, it is clear, that whatever advantage might eventually accrue to the conductors, the probable result to the shark was a cruel death, and one is consequently the more inclined to admire how the narrative itself should find place in a *Memoir Sur l'affection mutuelle des quelques animaux*!

The pilot-fish in question is chiefly a Mediterranean species, although it also spreads into distant oceans, having been found by Daldorf under the equator. A great extent of geographical distribution may indeed be expected in reference to a species which is said to suffer itself to be led away immense distances in its eager pursuit of ships. Dutertre records that he saw one which followed his vessel for more than 500 leagues. Whether he kept his eye upon it night and day during all that time, or in what other way he ascertained it to be the same individual throughout so long a traverse, is what he does not state, and we therefore cannot explain. "In the year 1831," Mr Yarrell observes, "two specimens of pilot-fish were caught on the opposite side of the British Channel, and more than one instance has occurred of their following ships into Guernsey. A few years since, a pair accompanied a ship from the Mediterranean into Falmouth, and were both taken with a net. In January 1831, the *Peru*, Graham master, put into Plymouth, on her voyage from Alexandria for London, after a passage of eighty-two days. About two days after she left Alexandria, two pilot-fish, *Gasterosteus ductor*, made their appearance close alongside the vessel, were constantly seen near her during the homeward voyage, and followed her into Plymouth. After she came to an anchor in Catwater, their attachment appeared to have increased; they kept constant guard to the vessel, and made themselves so familiar, that one of them was actually captured by a gentleman in a boat alongside, but, by a strong effort, it escaped from his grasp, and regained the water. After this the two fish separated; but they were both taken the same evening, and, when dressed the next day, were found to be excellent eating. In October 1833 nearly one hundred pilot-fish accompanied a vessel from Sicily into Catwater, but they were not taken."² The pilot-fish is of a silvery blue colour, paler below, with

¹ *Annales du Mus. d'Hist. Nat.* t. ix. p. 469. In further illustration of the subject, we shall subjoin a short extract from a recent publication, Dr Meyen's *Reise um die Erde*. "The pilot swims constantly in front of the shark; we ourselves have seen three instances in which the shark was led by the pilot. When the sea-angel neared the ship, the pilot swam close to the snout, or near one of the breast fins of the animal; sometimes he darted rapidly forwards or sideways, as if looking for something, and constantly went back again to the shark. When we threw overboard a piece of bacon fastened on a great hook, the shark was about twenty paces from the ship. With the quickness of lightning the pilot came up, smelt at the dainty, and instantly swam back again to the shark, swimming many times round his snout, and splashing, as if to give him exact information as to the bacon. The shark now began to put himself in motion, the pilot showing him the way, and in a moment he was fast upon the hook. Once we watched a pilot for many days, who kept constantly swimming close before the keel of the ship. The sailors say, as of a thing well known and familiar, that such a fish so situated has lost his shark, and is seeking another. Upon a later occasion, we observed two pilots in sedulous attendance on a blue shark, which we caught in the Chinese Sea. It seems probable that the pilot feeds on the shark's excrements, keeps his company for that purpose, and directs his operations solely from this selfish view." On this very singular subject we are tempted to quote another anecdote, which, notwithstanding what we have said in the text above, if correctly observed and recorded, would certainly indicate something remarkable in the association of these species. The account was furnished to the editor of the English edition of the *Animal Kingdom* (vol. x. p. 636), by Colonel Hamilton Smith, an accurate and accomplished naturalist. "Captain Richards, R. N., during his last station in the Mediterranean, saw on a fine day a blue shark, which followed the ship, attracted perhaps by a corpse which had been committed to the waves. After some time a shark-hook, baited with pork, was flung out. The shark, attended by four pilot-fish, *Scomber ductor*, repeatedly approached the bait; and every time that he did so, one of the pilots, preceding him, was distinctly seen from the taffrail of the ship to run his snout against the side of the shark's head, to turn it away. After some farther play, the fish swam off in the wake of the vessel, his dorsal fin being long distinctly visible above the water. When he had gone, however, a considerable distance, he suddenly turned round, darted after the vessel, and before the pilot-fish could overtake him and interpose, snapped at the bait and was taken. In hoisting him up, one of the pilots was observed to cling to his side until he was half above water, when it fell off. All the pilot fishes then swam about awhile, as if in search of their friend, with every apparent mark of anxiety and distress, and afterwards darted suddenly down into the depths of the sea. Colonel H. Smith has himself witnessed, with intense curiosity, an event in all respects precisely similar."

² *British Fishes*, p. 151.

Acanthop-
terygii.
Scombe-
ridæ.

bands of deeper blue upon the upper portions. It varies from four inches to a foot in length, and the larger individuals have much the aspect of a mackerel. The name of *pilot* has been bestowed on various other fishes, and the genus *Naucrates* itself contains several species. *N. Indicus*, Cuv. was brought from Amboyna by Messrs Lesson and Garnot.

Other genera of this tribe are ELACATE, LICHIA, CHORINEMUS, and TRACHINOTUS, which we cannot here do more than name.

GENUS RHINCHOBDELLA, Bl. and Schn. Free spines on the back, as in the preceding genera, and two free spines in front of the anal fin, but the ventrals are absent, as in *Xiphias proper*. The body is lengthened.

Of this genus Cuvier has formed two minor groups,—RHINCHOBDELLA (*Macrognathus*, Lacép.), including such species as have the muzzle concave, and striated beneath, and the three vertical fins separate; and MASTACOMBLUS, Gronovius, containing such as have the muzzle simply conical, neither striated nor concave, and the vertical fins more or less completely joined.

The species of both genera inhabit the fresh waters of Asia, and are widely distributed, from Syria to the isles of Sunda, the Moluccas, and China. Their snouts are furnished with a delicate organ of touch, and it appears that they employ it while searching in the mud for small worms, or other slender substances on which they feed. They are generally regarded as *poissons de bon gout*, the flavour of their flesh bearing some resemblance to that of eels.

The genus NOTOCANTHUS (of which *N. Nasus* is the sole species) is characteristic of the most northern seas.

We next proceed to a group of the Scomberidæ which forms the THIRD GREAT TRIBE, distinguished by having the sides furnished with a cuirassed lateral line.

In the tunnies, sword-fish, and other Scomberidæ already discussed, a projecting cartilaginous portion is observable, forming a kind of ridge or keel on each side of the tail, at the extremity of the lateral line. In the genera of the same family of which we have now to treat, this ridge is no longer a simple prominence of the dermis, but is covered by scaly shields, themselves crested, and overlapping each other. These shields, frequently ending in a point or hook, are not always confined to the termination of the lateral line, but sometimes spread over its entire length, and usually occupy a considerable portion. In relation to this character, however, the tribe may be divided into two sections: the first of which, comprising only the great genus *Caranx*, exhibits this kind of armour in its greatest strength and extension; while the second (of which the genus *Vomer* is the type) shows its gradual reduction to small scales, not surpassing those of the rest of the body.

GENUS CARANX, Cuv. Lateral line armed to a greater or less extent with scaly shields, raised into a keel, and pointed.

As an example, we here figure the *Caranx boops*, a beautiful fish from Amboyna, of a fine silvery hue, tinted towards the back with brilliant steel blue, with green reflections. A pure line of orange extends from the gills to the tail, but this ornamental character is said to disappear speedily after death. The pectoral fins are likewise orange. It varies from a few inches to a foot in length. See Plate CCCII. fig. 12. The genus is extremely numerous, containing probably not fewer than seventy different kinds; but the only other species we shall here notice is a fish called the *scaad*, or horse-mackerel (*Caranx trachurus*, Lacép. and Cuv.), which occasionally occurs in prodigious shoals along the British shores. Ten thousand have been

taken by a foot-sean in a single evening in August. It likewise occurs in the Mediterranean, and in the vicinity of Madeira.

Acanthop-
terygii.
Scombe-
ridæ.

Of genera allied to CARANX, and consisting chiefly of species heretofore and erroneously referred to ZEUS, Baron Cuvier has established or retained the following, viz. OLISTUS, SCYRIS, BLEPHARIS, GALLICHTYS, ARGYREYOSUS, VOMER, and HYNNIS. Of these our restricted limits prevent our exhibiting the detailed characters. We shall merely present the reader with a figure of that singular little fish *Gallichtys Egyptiacus*, brought by Ehrenberg from the neighbourhood of Alexandria. It measures only from one to two inches in length, and is of a truly remarkable form. See Plate CCCIII. fig. 1.

We have now arrived at the concluding group or FOURTH GREAT TRIBE of the Scomberidæ, in which the *finlets*, the *free spines of the back*, and the *armour of the sides of the tail*, are all wanting.

The genera of this tribe, it will be perceived, are combined by means of merely negative characters, and it may therefore be expected that they will exhibit mutual relations of a less intimate kind than those of the preceding tribes. They form in fact a group, as it were, by continuity,—one of those series of which there are many in nature, and of which the agreement is not the less evident and harmonious, although it may be difficult to point out a precise character in common.

As we have little to say of general interest regarding their history or habits, we think it more suitable to the nature of this article to reserve a principal portion of our allotted space for the elucidation of those species concerning which some important or amusing information has been recorded. We shall therefore do little more than name the genera of our present tribe.

The genus SERIOLA scarcely differs from *Caranx*, except in the lateral line being either unprovided with a cuirass, or at least merely furnished with scales which slightly surpass those of the rest of the body. *S. Dumerilii* of Risso occurs near Nice, and elsewhere in the Mediterranean. It sometimes attains to the great weight of nearly 200 pounds, and dwells in deep and inaccessible places of the sea, rarely approaching the shores, unless when compelled to do so by hunger. Its flesh is of a reddish colour, firm, and of an exquisite flavour.

The genus TEMNODON greatly resembles the preceding, but its teeth are cutting. There are two small spines in advance of the anal fin, but almost concealed beneath the skin. We here place the *Perca saltatrix* of Linn. called *skip-jack* by the Americans. Its geographical distribution is extremely extensive.

The genus NOMEUS, Cuv. was for a long time combined with the Gobies. It is related in several particulars to *Seriola*, but the very large broad ventrals, attached to the body by their inner edge, produce a peculiar character and aspect. We here figure a small species, of which the ground colour is like brilliant silver. The ventrals are traversed by two black bands. It was transmitted to the Museum of the Low Countries from Java, by MM. Kuhl and Van Hasselt. See Plate CCCIII. fig. 4. Three other genera are described by Cuvier in this portion of his great work,¹ which, however, we shall merely name,—viz. NAUCLERUS, PORTHONEUS, and PSENES. The next genus is of more general interest.

GENUS CORYPHÆNA, Linn. Body compressed, elongated, covered by small scales; head compressed, profile circular; eyes low, approaching the angle of the mouth; dorsal fin rising from the cranium, and stretching con-

¹ Hist. Nat. des Poissons, t. ix. pp. 247-67.

Acanthop-
terygii.
Scombe-
ridæ.

tinuously to the tail, towards which it decreases in elevation.

This noted genus has been remodelled in recent times, and now consists of the following minor groups.

1st. Genus *CORYPHÆNA* proper. Cuv. Head very elevated, profile curved and perpendicular, eyes low; mouth well cleft; teeth like those of a wool card.

The generic term is derived from *κορυφή*, *vertex*, or top of the head, in reference to the height of the crest of the cranium. This division contains the famous *dolphin* of the Mediterranean (*Cor. hippurus*, Linn.), so celebrated for the beauty of its versatile tints.

..... parting day
Dies like the dolphin, whom each pang imbueth
With a new colour as it gasps away,
The last still loveliest, till—'tis gone—and all is gray.

The species are still in some measure indistinctly characterized. They occur in the Pacific and Atlantic Oceans, and the Mediterranean Sea, and are remarkable, among other things, for their keen pursuit of flying fish, which, in the first place, they force to leave their native element, and then following swiftly in a corresponding track, receive with open mouth the moment they descend exhausted to the surface. The *Coryphænæ* may be regarded as among the most brilliant inhabitants of the sea. It is necessary, according to Bosc, to have seen them following a vessel in troops, before we can form a proper estimate of their beauty. When they swim embodied near the surface, and beneath the light of a cloudless sky, they seem effulgent with the richest gold, combined with the sparkling lustre of the topaz, the emerald, and the sapphire,—and every brilliant hue in perpetual change, accordant with the vivacity and varied grace of their movements. It is indeed a spectacle sufficient anywhere to excite our unfeigned admiration; and when seen suddenly amid the waves of the lonely and monotonous ocean, it comes upon us like a glad surprise. The beauty of these fishes has in every age attracted the wonder

Of all who on the wide deep wandering are;

and it is so far to be regretted, that their fugitive colours have been the chief object of attention,—their more precise description and specific discrimination having been greatly disregarded.

The *Coryphænæ* are strong, active, and voracious fishes. While swimming rapidly, they seem rather as if impelled or projected forwards by some exterior force, than by any exertion of their own. But, on attentive examination, a strong and rapid muscular movement may be detected, by the constant undulation of the long dorsal fin, a movement which greatly contributes to the throwing off of those lustrous metallic reflections for which they have so long been noted. The Mediterranean species, *Cor. hippurus*, if not the most beautiful, is the largest known. It sometimes attains to the length of five feet. Its colours, so far as they are capable of description, are silvery blue above, with markings of a deeper azure, and reflections of pure gold—the lower parts citron yellow, marked with pale blue. The pectoral fins are partly lead colour, partly yellow; the ventrals are yellow on their under surface, and black above; the anal fin is yellow. The iris of the eye is made of apparent gold.¹

One or two other kinds, not so distinctly known, occur in the Mediterranean, and many others in more distant seas. We here figure a large species, measuring nearly four feet in length, taken by M. Dussumier about fifty leagues to the west of the Azores, for which reason it bears the name of *Coryphæna Azorica*, see Plate CCCIII. fig. 2. The Portuguese name more than one species *Dorada*, a term which, from its similarity to *Daurade* (a frequent appellation of our gilt-head, *Chrysophris aurata*), has produced some confusion. Not less ambiguous is the name of *Dolphin*, which appears to have been first misapplied to the *Coryphænæ* by the Dutch. It is scarcely necessary to observe, that the English word *Dolphin*, as synonymous with the Greek *Δελφίς*, the Latin *Delphinus*, and the French *Dauphin*, was originally, and is still correctly, applied only to designate a group of cetaceous animals (allied in structure to the whales), to which the classical dolphin of antiquity assuredly belonged. But by some conversion, into the history of which it is not worth while to inquire, the term has been applied by most modern writers, particularly poets, to a creature of another class, a genuine fish, of the genus *Coryphæna*. No fault therefore can be imputed to the naturalist, if the general misapplication of the term is now found to occasion any misconception. There is no doubt, however, that the animal beloved by gods and men, the *Hieros Ichthys* of the heroic Greeks, and the revered symbol of the *Delphic* Apollo, was nothing more than a pellock or porpoise.²

2d. Genus *LAMPUGUS*,³ Cuv. Head oblong; central crest of the forehead much lower than in *Coryphæna*; dorsal fin equal, and low throughout its whole extent.

More than one species occurs in the Mediterranean, but the most common in that sea is *L. pelagicus*, which almost in every thing resembles the so-called dolphin, except in the form of its head, and more diminutive dimensions.

3d. Genus *CENTROLOPHUS*, Lacép. Form more lengthened; palatine teeth wanting; an interval between the occiput and the commencement of the dorsal fin.

Most of the species occur in the Mediterranean; and the *black perch* of Pennant, the *black fish* of Couch and Yarrell (*Cent. pompilus*, Cuv.), is referrible to this genus. It is a fish of great strength and velocity, measuring from two to three feet, and is one of our rare British species.

GENUS *ASTRODERMUS*, Bonelli. Head elevated and sharp; mouth slightly cleft; only four branchial rays; ventrals very small, and placed upon the throat; scales scattered upon the body, and assuming the radiated form of little stars. It is from the latter circumstance that the genus derives its name.

There is only a single species of this genus,—recently discovered, and still extremely rare. It has been taken near Nice, and also in the Gulf of Cagliari in Sardinia, and was originally described by M. Risso under the name of *Coryphæna elegans*.

GENUS *PTERACLIS*. Head and teeth as in *Coryphæna*, but the scales are larger, the ventrals very small, and placed upon the throat; the dorsal and anal fins prodigiously extended.

This eccentric genus is founded on a fish described by Pallas in his *Spicilegia*, under the name of *Coryphæna ve-*

¹ Every voyager seems to describe the dolphin in his own way; and it is by no means easy for a landsman to ascertain which is the right one. The play of colour, as it is called, may no doubt admit of great diversity in the expressions used. The above description is from the recorded observation of the living fish by M. Biberon. Another eye-witness, Colonel Bory St Vincent, describes the back as being of a sea-green colour, sprinkled with orange spots; the abdomen silvery; the lateral line yellow; the dorsal fin celestial blue, with golden-coloured rays; the caudal fin surrounded by a green hue; the other fins yellow. (*Dictionnaire Classique d'Hist. Nat.* t. iv. p. 528.)

² Wilson's *Illustrations of Zoology*, vol. i. article DELPHINAPTERUS.

³ Synonymous with the genus *Caranxomus* of Lacépède, which was adopted by Cuvier in the *Règne Animal*, but is now, so far as the name is concerned, handed over to oblivion.

Acanthop-
terygii.
Scombe-
ridæ.

Acanthop-
terygii.
Scombe-
ridæ.

lifera, and it was with a feeling of doubt that Cuvier placed it where it now stands. It is not easy to conceive the use of its dorsal and anal fins, so enormously large in proportion to the size of the body. Pallas indeed imagined that they might serve to sustain it in the air; but in that case the fish must fly, as a flounder swims, upon its side. The species are unfortunately so rare, that it may be long before an opportunity occurs of throwing any light upon the subject. The only known specimen of *Pt. ocellatus*, Cuv. was taken entire from the stomach of a bonito in the Straits of Mosambique. The species represented in this work (See Plate CCCIII. fig. 3) was brought to Europe by MM. Quoy and Gaymard, but we know not from what locality.

GENUS STROMATEUS, Linn. Distinguished among the Scomberidæ by the want of the ventral fins, and by a single dorsal, the spiny rays of which, few in number, are concealed in its anterior margin. The vertical fins are covered by scales, as among the Squammipennes.

The Mediterranean produces a beautiful species (*St. frotola*, Linn.), remarkable for its spots and broken bands of gold upon a lead-coloured ground. The *black pomfret* of India, a delicious fish for table uses, pertains to this genus. It is the *St. niger* of Bloch. According to Russel, it is abundant at Vizagapatam during the months of March and April, and vanishes and re-appears alternately every two or three days. It requires to be eaten immediately after capture. A singular circumstance in the geographical history of this genus is, that although the species seem common along a great extent of Indian coast, and spread as far as China, none is known at the Isle of France, nor in any part of the Indian Archipelago.

GENUS RHOMBUS,¹ Lacép. Extremity of the pelvis forming, anterior to the anus, a small pointed and cutting blade, which resembles a vestige of the ventral fins.

As an example, we may mention the *Harvest fish* of New York, an excellent article for the table. It is the *Rh. longipinnis* of Cuvier, erroneously placed by Linnæus among the Chætodons.

The genus LUVARUS of Rafinesque resembles the preceding. There is only one species distinctly known (*L. imperialis*), a fish of fine flavour, but extremely rare. It measures five feet in length; the whole body is of a reddish silvery colour, more obscure upon the back. It was dashed ashore near Solanto, in Sicily.² A species unknown to the fishermen was taken in 1826, at Isle-de-Ré, which Cuvier regards as referrible to this genus. The genus SERPINUS, Cuv. possesses the characters of Stromateus, but very small ventrals are perceptible, or at least the vestiges of these organs are apparent. The only known species is *S. Rondeletii*, a small fish of the Mediterranean.

GENUS KURTUS, Bloch. Allied to Rhombus, but differs in the dorsal fin being shorter, and the ventrals more developed. The scales are so fine as to be imperceptible in the dried state. There are seven branchial rays. The pelvis shows a spine between the ventrals, and several small cutting blades are visible anterior to the dorsal fin,

at the base of which is a spine directed horizontally for-wards.

The skeleton in this genus presents a striking peculiarity in the ribs, which are dilated, convex, and in the form of rings which come in contact with each other,—thus enclosing a conical empty space, which is prolonged beneath the tail, in the inferior rings of the vertebræ, into a long thin tube enclosing the swimming bladder. The species inhabit the Indian seas, and are few in number. *K. cornutus*, called *somdrum-hara-moddee* at Vizagapatam, and which Cuvier regards as the male of *K. Blochii*, Lacépède, is an excellent eating fish, remarkable for being almost transparent in a state of freshness.

We shall conclude our exposition of the Scomberidæ by a brief notice of the genus ZEUS, Linn. from which some of the preceding genera, such as *Gallychtis*, *Argyreus*, &c. have already been detached. In its more restricted form it contains fishes of a compressed body, protractile mouth covered by small scales, with teeth feeble and few in number. It is further divisible as follows:

GENUS ZEUS, Cuv. Dorsal fin emarginate, its spines accompanied by long slips of the membrane; a series of forked spines along the base of the dorsal and anal fins.

The type of the genus is *Zeus faber*, commonly called the *Dory* (Plate CCCIII. fig. 5), probably from the French term *dorée*, in allusion to the golden tints of its body.³ Its surface has at the same time a smoked appearance, on which account the French name it *forgeron*, a word which corresponds to the Latin trivial name of *faber*, or blacksmith. It is also called the *fish of St Peter*, from an ancient traditionary belief that it was from the mouth of this species that the apostle extracted the tribute-money, and the black spot on either side of its body is supposed to be a record of its capture at that time.⁴ The dory is a fish greatly esteemed for the table. It occurs both in the Mediterranean Sea, and along the oceanic coasts of Europe. According to Pennant, the largest are found in the Bay of Biscay. Willaghy alludes to it as common in his day on the shores of Cornwall; and it is still taken both there and along the Devonshire coast, occasionally even in profusion. Mr Couch, as quoted by Mr Yarrell, considers the dory rather as a wandering than a migratory fish, and as regulated in a great measure by the movements of the smaller kinds on which it preys. When the pilchards approach the shore, it is frequently taken in considerable numbers. In the autumn of 1829, more than sixty were hauled on shore at once in a net, some of them of large size, and yet the whole were sold together for nine shillings. The largest specimens of the London market weigh from ten to twelve pounds, but the average weight is scarcely more than five. The dory is a bold, voracious species, preying greedily upon the more timid kinds, and pouncing readily upon all sorts of bait. Its flesh was highly esteemed in the time of Pliny. Columella, who was a native of Cadiz (where it was regarded as the best of fishes), has recorded that it had been long known by the name of *Zeus*—a designation which in

Acanthop-
terygii.
Scombe-
ridæ.

¹ In the second edition of the *Règne Animal*, this genus bears the name of PEPRILUS; Cuvier not having been at that time aware that it had been previously designated by Lacépède under the name of *Rhombus*. We deem the choice of the latter name equally unfortunate, seeing that it had been previously applied generically to that group of the Pleuronectidæ called *Turbots*. But we leave it to more influential authors to propose a second change.

² Rafinesque, *Caratteri di alcuni nuovi generi, &c. della Sicilia*, p. 22.

³ A variety of derivations, however, have been assigned to the English name. In addition to the one above alluded to, we shall merely mention the following: St Christopher, while wading through an arm of the sea, and bearing the infant Saviour, is said to have caught a dory, and to have impressed its sides with the two peculiar marks, as a perpetual record of the fact. The name was therefore said to be from the French *adorée*, worshipped, as something unusually sacred. The designation of *John Dory* is in all probability derived from the French *jaune dorée*, in allusion to the tints of a golden yellow hue with which it is adorned. Some, however, refer it (and again in connection with St Peter) to the Italian term *janitore*, or door-keeper, by which it seems the species is known to the fishermen of the Adriatic.

⁴ The common haddock also bears a share in this tradition.

Acanthop-
terygii.
Tænioidæ.

itself argues pre-eminence, *Zeus* in Greek signifying the monarch of the gods.

GENUS *CAPROS*, Lacép. Dorsal fin emarginate, as in the preceding, and the mouth still more protractile; but there are no spines to either the anal or dorsal fin. The body is covered with strong rough scales.

The only species with which we are acquainted is the *Zeus aper* of Linn. a small fish of the Mediterranean. A specimen was taken in Mounts Bay in October 1825,¹ and more recently it was observed in the Bridgewater fish-market, as we are informed by W. C. Trevelyan, Esq.

GENUS *LAMPRIS*, Retzius. A single dorsal fin, high in front, where it is furnished with one or two small spines. The ventrals have ten long rays, and the lobes of the caudal fin are considerably elongated, but these prolongations seem to become effaced by age. The sides of the tail are carinated.

The only known species (*L. guttatus*, *Zeus luna*, Gmelin) occurs, though rarely, off the French coasts, and in the British seas, where it is known as the *opah* or king-fish. It is one of the most splendid and remarkable of European fishes. Its back is of a deep blue spotted with silver,—the rest of its body like polished gold, reflecting all the colours of the rainbow. It is certainly sufficiently singular that a species included by Nilsson in his *Prodromus* of the fishes of Scandinavia, should likewise be enumerated by Kæmpfer as occurring in Japan. The opah is a fish of great size, measuring sometimes five feet in length. Its flesh is said to taste like beef. See Plate CCCIII. fig. 6.

The remaining genera are *EQUULA*, Cuvier, and *MENE*, Lacépède. The *Zeus insidiator* is an example of the former,—the *Zeus maculatus*, of the latter.

FAMILY VIII.—TÆNIOIDÆ.

This family is closely connected with the Scomberidæ. The species are of a very lengthened form, and flattened laterally, from which they have obtained the name of ribbon-fishes. Their scales are very small.

The first tribe² comprehends those genera of which the mouth is small, and but slightly cleft.

GENUS *GYMNETRUS*, Bloch. Body elongated and flat; anal fin entirely wanting; dorsal fin long, with prolonged anterior rays, which, however, are easily broken; ventrals also very long, when not worn away by use, or otherwise fractured; the caudal, composed of few rays, rises vertically on the extremity of the tail, which finishes in a little hook. There are six branchial rays.

The species are so soft and tender that they often present themselves as it were with false characters, from the natural mutilation of the rays. For this reason they are as yet indistinctly characterized by systematic writers. Even the central skeleton, and especially the bones of the vertebræ, are extremely soft. The stomach is long; there are numerous cæca; the swimming bladder is wanting; and the flesh, of a mucous nature, decomposes with great rapidity. The European species occur in the Mediterranean, and also occasionally in the British and more northern seas. The fish called *king of the herrings* by the Norwegians belongs to this genus. We here figure as

a curious example the *Gymnetrus falx*. See Plate CCCIII. fig. 8. We may add, that the *Gymnetrus Hawkenii* of Bloch, a species originally described from a specimen taken near Goa, in the Indian Sea, was many years ago drawn ashore dead on the south coast of Cornwall. It measured nearly nine feet, and weighed forty pounds. The *vaagmaer*, or *deal-fish*, has also been recorded by Dr Fleming as a British species.³ It is the *Gymnetrus Arcticus* of systematic authors.

That very singularly-formed fish, the *Stylephorus cordatus* of Shaw, forms the remaining genus of the present tribe.⁴

In the second tribe of TÆNIOIDÆ the muzzle is short, and the mouth obliquely cleft.

GENUS *CEPOLA*, Linn. Dorsal and anal fin long, each reaching to the base of the caudal, which itself is rather large; the cranium is not raised or crested; the muzzle is very short, with the superior curved upwards; the teeth are distinct, and the ventral fins perceptibly developed. There are a few unarticulated rays in the dorsal fin, which are as flexible as the others; the spine of the ventrals alone being stiff and pointed. There are six branchial rays. Both the abdominal cavity and stomach are very short. Some cæca are perceptible, and a swimming bladder, which extends into the caudal extremity. The occasional occurrence of a Mediterranean species of this genus (*Cep. rubescens*, Linn.) along the coasts of Devon and Cornwall has been recorded both by Montagu and Couch.⁵

GENUS *LOPHOTES*, Giorna. Head short, surmounted by a raised osseous crest, on the summit of which is articulated a long and powerful spiny ray, bordered behind by a membrane, and followed by a low simply rayed continuous fin, which spreads onwards to the point of the tail. Caudal fin distinct but small; and beneath the above-mentioned point there are two scarcely perceptible ventral fins furnished with four or five exceedingly small rays. The teeth are pointed, and not very close together; the mouth directed upwards, and the eyes very large. There are six branchial rays, and the abdominal cavity occupies almost the entire extent of the body. We are acquainted with only a single species (*Loph. Lucepe-dianus*), which inhabits the Mediterranean, where, however, it is extremely rare. It attains to a large size, that is, to about four feet in length.⁶

FAMILY IX.—THEUTIDÆ.

This family is perhaps as closely allied to the Scomberidæ as the preceding, but its alliance proceeds from other points,—such as the armature of the sides of the tail in several genera, or the horizontal spine anterior to the dorsal fin in others. It comprises but a small number of foreign genera, with compressed oblong bodies, small mouths, slightly or not at all protractile, armed on each jaw with cutting teeth upon a single range, the palate and tongue without teeth, and a single dorsal fin. The species are of herbivorous habits, feeding chiefly on fuci and other marine vegetation. Their intestines are ample. We are compelled to be brief in our indications of the generic groups.

The genus *SIGANUS*, Forsk. of which the species are

¹ *Proceedings of the Zoological Society*, 1833, p. 113.

² In the *Règne Animal*, t. ii. p. 217, the first tribe of the family above named is composed of the genera *Lepidopus* and *Trichiurus*, which, however, in Cuvier's later work (*Hist. Nat. des Poissons*, t. viii. p. 217) are placed as an appendix to the first tribe of the Scomberidæ, where we have accordingly placed them in the present article. We therefore commence the TÆNIOIDÆ with what was formerly the second tribe.

³ *Magazine of Nat. Hist.* vol. iv. p. 215.

⁴ *Linn. Trans.* vol. vii. p. 291, and vol. xiv. p. 17.

⁵ See *Mem. de l'Acad. de Turin*, 1805-8, p. 19; and *Ann. du Muséum*, t. xx. fig. 17.

⁶ See *General Zoology*, vol. iv. part i. p. 87.

Acanthop-
terygii.
Labyrin-
thiform
Pharyn-
geals.

numerous in the Indian seas, is characterized by a feature believed to be unique among fishes, that of having both the outer and inner ray of the ventral fins spiny. The genus *ACANTHURUS*, Bloch, has the teeth cutting and dentated, and a strong moveable spine on each side of the tail, capable of inflicting a severe wound on those who grasp it incautiously. On this account a species greatly sought for in the West Indies as food has received the name of surgeon, *Ac. Chirurgus*. As an example we here figure the *Acanthurus Delisianus*. See Plate CCCIII. fig. 7. In the genus *NASEUS* the sides of the tail are armed with fixed spines, and the teeth are conical. The great peculiarity, however, consists in a horn-like prominence on the front of the head. The skin resembles leather. Forskall relates of one species (*N. fronticornis*, Lac.) that although of peaceable demeanour and herbivorous habits, it knows how to defend itself from unprovoked aggression; and he reports the observations of some Arabian fishermen, who saw a troop of them come to the rescue of a companion who had been transfixed on the surface of the water by an eagle. They so bothered the "Bird of Jove" as eventually to produce his death by drowning. This, however, savours more of an "Arabian Tale" than of a fact in natural history. See Plate CCCIII. fig. 9. The reader will perceive in the two preceding representations a resemblance to the genus *Chætodon*. The remaining genera of this small family are *AXINURUS* and *PRIDON*, Cuv.

FAMILY X.—LABYRINTHIFORM PHARYNGEALS.

By this term Baron Cuvier means to designate the peculiar structure of a part of the upper pharyngeal bones, which are divided into leaflets more or less numerous and irregular. This formation produces cells capable of containing water, which flows upon and moistens the branchiæ for some time after the fish itself has been removed from its natural element; and this refreshing influence is rendered the more effectual by the closeness of the opercula or gill-covers. The consequence is, that most of the species possess the power of quitting their streams and pools, and creeping, as it were, to some little distance from their watery homes,—a faculty not unknown to ancient writers, and one which in India has led to the belief that these fishes fall from heaven.

GENUS *ANABAS*. In this genus the labyrinths alluded to attain the greatest degree of complication. Nevertheless the third pharyngeals have teeth *en pavés*, and there are others beneath the back of the cranium. The body is round, covered by strong scales; the head large; the muzzle short and obtuse; the mouth small; the lateral line interrupted about its posterior third. The margins of the opercle, sub-opercle, and inter-opercle, are strongly toothed, but not those of the pre-opercle. The branchial membrane has five rays. There are many spiny rays to the dorsal, and even to the anal fin. The stomach is of medium size, rounded. The pylorus has only three appendices.

The generic name is derived from the Greek, *αναβαινω*, to ascend, and refers to the singular instinct of the only known species (*An. scandens*, Plate CCCIII. fig. 11), which induces it to climb trees.¹ It performs this action by means of the spiny processes of the gill-covers, and moves at pleasure up the trunks of trees which grow by the water side. It was observed by Lieutenant Daldorf, at Tranquebar, ascending by a fissure in the stem of the

palm called *Borassus flabellifer*, and was also found to be so tenacious of life as to move about upon the dry sand for some hours after it was captured on the tree.² At the same time other respectable observers who have attended to this species in its natural state, make no mention of the fact. M. Reinwardt has frequently taken the *Anabas* at Java, but never heard any climbing propensities attributed to it; M. Leschenault, who transmitted several specimens to Pondicherry, simply observes that they dwell in rivers and fresh-water ponds; while Mr Hamilton Buchanan proceeds still further, and not only denies the fact, but regards it as contrary to the laws of nature. One point, however, is certain, that it is capable of living an unusual length of time out of the water, a fact in perfect accordance with the peculiar structure of its pharyngeals. It also creeps about upon the ground for hours together, and the fishermen are alleged to keep it alive for five or six days in a dry vessel. It is thus brought alive to the markets of Calcutta from the great marshes of the district of Yazor, which are distant more than a hundred and fifty miles. "Les charlatans et jongleurs," says Cuvier, "dont l'Inde abonde, ont généralement de ces poissons avec eux dans des vases, pour amuser la populace de leurs mouvemens."³

Passing over the nearly allied genera of *HELOSTOMA*, *POLYACANTHUS*, *COLISA*, and *MACROPODUS*, we arrive at the

GENUS *OSPIRONEMUS* of Commerson, of which the forehead is somewhat concave, the anal fin larger than the dorsal, the sub-orbitals and base of the pre-opercle finely dentated, and the first soft ray of the ventrals remarkably prolonged. There are six branchial rays, and the general form of the body is much compressed.

This genus contains the *Os. olfax*, or *Gourami*, one of the most famous for its flavour of all the fishes of the East. See Plate CCCIII. fig. 10.) It grows as large as a turbot, and is even more delicious than that favourite food. Commerson has recorded in his manuscript that he never tasted so exquisite a fish,—"*Nihil inter pisces tum marinos tum fluviatiles exquisitius unquam degustavi*;" and he adds, that the Dutch of Batavia rear them in large earthen vessels, renewing the water every day, and feeding them on aquatic plants, particularly *Pistia natans*. That navigator was also of opinion that the species had been imported originally from China to the Isle of France, and it appears to have been recently conveyed to the French colonies in South America by Captain Philibert. Its importation to Europe would be well worth attempting, and would probably be attended by success if the Gourami, like the golden carp, is actually a native of China. It does not, however, appear that any mention is made of it in any natural history notices of that empire, and it seems as yet unknown in India. It is said that the female Gourami hollows out a little foss in the side of the pond where she is kept, for the purpose of depositing her eggs in safety.

The remaining genera of this group are *TRICHOPIUS*, *SPIROBRANCHUS*, and *OPHICEPHALUS*. Of the former two only a single species is known of each. The last named is more numerous, and is deserving of a brief notice.

The *Ophicephali* resemble all the preceding genera of the family in the majority of their characters, and particularly in the cellular disposition of their pharyngeals, which seem equally adapted for the singular retention of water before alluded to. They can consequently also creep to a considerable distance from their liquid abodes; but what particularly distinguishes and even separates them from all

Acanthop-
terygii.
Labyrin-
thiform
Pharyn-
geals.

¹ It is synonymous with *Perca scandens* of Daldorf, and *Coius coboius* of Buchanan. In the Tamoul language it is called *Panciri*, or the tree climber.

² Linn. Trans. vol. iii. p. 32.

³ Hist. Nat. des Poissons, t. vii. p. 332.

**Acanthop-
terygii.
Mugilidæ.** other acanthopterygian fishes, is the absence of spines to the fins, except the single one to the ventrals, which itself, though simple, is neither stiff nor pointed. The body is elongated, and almost cylindrical; the muzzle short and obtuse; the head depressed, and furnished with polygonal scales, or rather plates, as in *Anabas*. It may be said, however, that it is by means of the solitary ventral spines alone that they exhibit the normal character of the great division of acanthopterygian fishes with which we have been hitherto engaged. They thus, by such ambiguous combination of character, almost break up the grand distinction of acanthopterygian and malacopterygian species, a distinction otherwise so well grounded as to have hitherto produced no disruption of the relations of natural affinity. "If it were possible," says Cuvier, "to admit that anomalous beings existed in nature, there is certainly none to which the title is so justly due as to the *Ophicephali*." Their watery reservoirs enable them to journey from one marsh to another, and they are moreover so tenacious of life that their bowels may be torn out, and themselves cut to pieces, without producing immediate death. They are often thus carried about alive, or sold in the markets slice by slice; and the consumers refuse to give the best price when so much has been cut away that the remainder ceases to move. This seems a parallel case to that of the beef-steaks from the oxen of Abyssinia. We here figure as an example of this singular genus the *Ophicephalus striatus*, a species which seems spread over the whole of India. See Plate CCCIII. fig. 12. Buchanan describes another species under the name of *Gachua* (*Oph. marginatus*, Cuv. ?), which sometimes grows to a foot in length. It is very common in the ponds and fosses of Bengal, and is one of the species most generally believed to fall from the clouds in wet weather. During the first heavy showers of the rainy season, they are certainly seen crawling on the grass; but their object in so doing is doubtless to escape from the corrupted water of the narrow dykes which they had previously inhabited, and to go in search of a purer element, and a fresher and more ample food. The species called *Barca* by Buchanan lives in holes in the vertical banks of the Brahmapootra, with nothing visible but its head, that it may the more readily observe and seize its prey. It is a large fish, measuring three feet in length, and is regarded as good eating. On the whole, however, the species of this genus are consumed rather by natives than Europeans,—the latter probably regarding them too much in the light of reptiles. We may add, that the *Ophicephali* are often exhibited by the Indian jugglers, and that even the children amuse themselves by forcing them to crawl upon the ground.

FAMILY XI.—MUGILIDÆ.

The fishes which compose our present group (corresponding to the genus *MUGIL*, of Linn.) exhibit so many peculiarities of organization, that Cuvier has deemed it advisable to form them into a distinct family. The body is almost cylindrical, covered with large scales, and furnished with two distinct dorsal fins, the first of which has only four spiny rays. The ventrals are attached somewhat behind the pectorals. The gills have six rays. The head is rather depressed, also covered with large scales or polygonal plates. The muzzle is very short. The transverse mouth forms an angle by means of a prominence of the middle of the lower jaw, corresponding to a depression of the upper one; and the teeth are excessively fine, indeed in some cases imperceptible. The pharyngeal bones, greatly

developed, give an angular form to the œsophagus resembling that of the mouth, which permits only fluids or very small substances to enter the stomach, notwithstanding which the latter terminates in a kind of fleshy gizzard, analogous to that of birds. The pyloric appendices are few in number, but the intestine is long and folded.

The species are excellent as articles of food. They resort in vast troops to the mouths of large rivers, where they may be observed continually springing out of the water.

The *Mugil cephalus*, or Mediterranean gray mullet (the English name must not mislead the unpractised reader to confound it with the genus *Mullus*, formerly described), is distinguished from all the other European species by its eyes, which are half covered by two adipose veils adherent to the anterior and posterior margin of the orbit, and by the peculiar concealment of the maxillary bone, which, when the mouth is closed, is completely hidden beneath the sub-orbital. The base of the pectoral fin is surmounted by a long carinated scale. See Plate CCCIII. fig. 13. The species just referred to is the best and largest of the Mediterranean kinds. It weighs about ten or twelve pounds, and does not appear to have been yet detected in the seas or estuaries of Britain, nor along the oceanic shores of France. It is very common on the coast of Spain, especially around the island of Ivica, where the fishermen are said to recognise two varieties under the names of *Mugil* and *Lissa*. When surrounded by a net, it endeavours, and often successfully, to effect its escape, by leaping over the edges into the unencumbered sea.¹

"Its hearing is very fine, as has been noticed by Aristotle, and it feeds on worms and small marine animals; but it is doubtful, though it has been advanced, that it can live on vegetable substances. It appears to be of a stupid character, a fact which was known in the time of Pliny, for that author tells us that there is something ludicrous in the disposition of the mullets; for if they are afraid they conceal their heads, and thus imagine they are entirely withdrawn from the observation of their enemies.

"When, towards the end of spring and the commencement of summer, the fishes of this species, excited by the necessity of living in the fresh water, approach the shores and advance towards the mouths of the rivers, they form such numerous troops that the water through which they are seen, without being clearly distinguished, appears to be bluish. This particularly happens in the Garonne and the Loire at these periods. The fishermen there adopt the plan of surrounding these legions of mullets with nets, the enclosure of which they gradually contract, taking care to make a noise to frighten the fish, and oblige them to press together, and heap themselves as it were one upon the other.

"Of the mullets thus taken some are eaten fresh, others are salted and smoke-dried; it is with their eggs salted, washed, pressed, and dried, that the preparation called *botarcha* is made, which is a condiment greatly in request in Italy and the southern provinces of France. The flesh of this mullet is tender, delicate, and of an agreeable flavour; it is fatter and more in estimation when it is taken in the fresh water. The ancients, who from the time of Aristotle were acquainted with this fish, had it in great request; and the consumption of it is still very considerable in most of the southern countries of Europe. According to the report of Athenæus, those mullets were formerly in very high esteem which were taken in the neighbourhood of Sinope and Abdera; while, as Paulus Jovius informs us, those were very little prized which had lived in the salt marsh of Or-

**Acanthop-
terygii.
Mugilidæ.**

¹ The *Mugil saliens* derives its specific name from the extraordinary velocity with which it springs into the air when it finds itself about to be enclosed.

Acanthop-
terygii.
Gobioidæ.

bitello in Tuscany, in the lagunes of Ferrara and Venice, in those of Padua and Chiozza, and such as came from the neighbourhood of Commachio and Ravenna. All these places in fact are marshy, and the streams by which they are watered are brackish, and communicate to the fish which they support the odour and the flavour of the mud.²¹

At the conclusion of this family Cuvier places the two following genera, the first of which is allied partly to the mullets and partly to the Scomberidæ, while the second partakes of characters intermediate between the Mugilidæ in general, and the ensuing family of Gobioidæ.

GENUS TETRAGONURUS, Risso, so called from two salient crests on each side, near the base of the caudal fin. The body is elongated; the spinous dorsal long, but very low,—the soft dorsal approximate, but higher and short, with an anal of corresponding form; the ventrals are a little behind the pectorals; the branches of the lower jaw are vertically raised, and furnished with a range of pointed cutting teeth, forming as it were a saw, and fitting, when the mouth is closed, into those of the upper jaw. The stomach is garnished interiorly with hard and pointed papillæ.

The only known species (*T. Cuvieri*, Risso) is found along the Mediterranean shores, but only at great depths. It is of a black colour, measuring about a foot in length, and is covered by hard, toothed, striated scales. Its flesh is said to be poisonous.

GENUS ATHERINA, Linn. Body elongated; dorsals wide apart; ventrals further back than the pectorals; mouth very projectile, and furnished with extremely small teeth. The transverse processes of the last abdominal vertebrae are bent so as to form a little conical bag for the reception of the point of the swimming bladder.

All the known species are characterised by a broad silvery band along the sides. They are highly esteemed for their delicacy; and the fry, which continue for a long time together in crowded troops, are eaten along the Mediterranean shores under the name of *Nonnat*. *A. hepsetus*, Linn. was till very recently regarded as indigenous to the seas and estuaries of Britain. There was reason, however, to believe that several species had been confounded under that name; and Mr Yarrell has ascertained that the British species, commonly called the Atherine, coincides in its characters with the *Atherina presbyter* of Cuvier. It is a common fish at Brighton, where, under the name of *sand-smelt*, it is eaten in large quantities by the inhabitants and visitors during the winter months. It partakes of the cucumber smell and flavour of the true smelt, and is a small handsome fish, measuring from five to six inches. It is rarely brought to the London market. It spawns in May and June.

FAMILY XII.—GOBIOIDÆ.

This family derives its name from the Linnæan genus *Gobius*, and is distinguished by having the dorsal spines

slender and flexible. The viscera of all the fishes pertaining to it are nearly of the same conformation; the intestinal canal is equal, ample, and without cæca, and there is no swimming bladder.

The species referrible to the genus *Blennius*, Linn. present a very distinctive character in having their ventral fins placed before the pectorals, and composed only of two rays. Their bodies are elongated and compressed, and they bear only a single dorsal, composed almost entirely of simple and flexible rays. They live in small companies in rocky streams, and can survive for a considerable time out of the water, in consequence of their skin being covered with a kind of mucus, a circumstance which has caused the Greek name *Blennius* to be applied to them. Many of them are viviparous, and both sexes have a tubercle near the anus, which seems to be subservient to the purposes of copulation. They are now arranged under the following genera:

GENUS BLENNIUS, Cuv. Includes the blennies properly so called, and is characterised by long, equal, and closely-placed teeth, forming only a single and rather regular row on each jaw, terminating behind in some species by a long and hooked tooth. The head is obtuse, the muzzle short, and the forehead vertical; the intestines broad and short. Several species occur along the coasts of Britain. Of these we may mention the butterfly blenny (*B. ocellaris*), distinguished by having the dorsal bi-lobed, the anterior lobe being very elevated, and marked with a round black spot, cinctured with a white and black circle. See Plate CCCIV. fig. 1.

GENUS MYXODES, Cuv. Separated from the blennies properly so called, in consequence of the head being elongated, the snout pointed, and projecting beyond the mouth; the range of teeth like those of the blennies, but without the canine teeth.

GENUS SALARIAS, Cuv. Teeth laterally compressed, hooked at the extremity, exceedingly slender, and in prodigious numbers. The head of these fishes is very much compressed superiorly, and of great breadth across the base: their lips are fleshy and thick, their forehead quite vertical, and their intestines, spirally convoluted, are longer and more slender than in the common blennies. All the known species are from the Indian Ocean.

GENUS CLINUS, Cuv. Teeth short and pointed, disposed in several rows, the first of which is largest. Their muzzle is less obtuse than in the two preceding groups, the stomach broader, and the intestines not so long.

GENUS CIRRHIBARBUS, Cuv. The general form is that of the preceding genus; the teeth are crowded, and there is a small tentaculum over the eye, and another on the nostril, besides three large ones at the extremity of the muzzle, and eight under the point of the lower jaw. Only one species is known, a native of the Indus. It is of a uniform reddish-yellow colour.

GENUS GUNELLUS. (*Muraenoides*, Lacép.) Distinguished from all the other blennies by having the ventrals so

¹ Griffith's edition of the *Animal Kingdom*, vol. x. p. 300. According to Baron Cuvier, Linnæus and several of his successors have confounded all the European mugils or gray mullets under the single specific name of *M. cephalus*. The French naturalist restricts that denomination to the species characterised above, and which has not yet been detected along our island shores. Our *gray mullet* is the *mugil capito* of Cuvier, an inhabitant not only of the Mediterranean, but also of all the western shores of the temperate parts of Europe. "The partiality," says Mr Yarrell, "exhibited by the gray mullet for fresh water has led to actual experiment of the effect of confining them to it entirely. Mr Arnould put a number of the fry of the gray mullet about the size of a finger into his pond at Guernsey, which is of about three acres area, and has been before referred to under the article *Basse*. After a few years, mullet of four pounds weight were caught, which proved to be fatter, deeper, and heavier for their length, than others obtained from the sea. Of all the various salt-water fishes introduced, the gray mullet appeared to be the most improved. A slight change in the external colour is said to be visible." (*British Fishes*, p. 205.) The same author informs us that the gray mullet is frequently an object of sport to the angler. They rise freely at the flies used for trout, and even at the larger and more gaudy flies used for salmon. They are strong in the water, and require a careful hand in consequence of their impetuous plunging. Our other British species are the thick-lipped gray mullet, *mugil chelo*, Cuv., and a small species described by Mr Yarrell under the name of short gray mullet, *mugil curtus*. We may here remark, that it is unfortunate that the English term *mullet* should be applied both to the subjects of our present note, and to the red and striped mullets, which belong to a very different genus of the family Percidæ, before described. If the latter were termed *surmulletts*, or the former *mugils*, the ambiguity of a double application of the same name would be avoided.

*Acanthop-
terygii.
Gobioidæ.* small as to be almost imperceptible, and often reduced to a single ray. The head is very small, and the body elongated like the blade of a sword; the back garnished throughout its whole length with a uniform dorsal fin, all the rays of which are simple and without articulations. The teeth are as in the genus *Clinus*, the stomach and intestines of a uniform character.

One species, the common gunnel (*B. gunnellus*), is very abundant on the coasts of Britain, and in other northern seas. It varies from six to ten inches in length, is of a yellowish-brown colour on the body, with the belly white, and the dorsal fin ornamented with a series of dark oscillated spots along the base.

GENUS *OPISTOGNATHUS*, Cuv. Presents the form of the blennies properly so called, but differs from them in having the maxillaries very large, and prolonged posteriorly into a kind of long flat moustache. The teeth in each jaw are rasp-like, the exterior range being strongest. The ventrals are placed exactly under the pectorals, and consist of three rays. Only one species seems to be known, which was brought from the Indian Ocean by M. Sonnerat, after whom it was named by Baron Cuvier.

GENUS *ZOARCUS*, Cuv. The species of this group are destitute of a spiny ray; they have an anal tubercle, the intestines are without cæca, and there are six branchial rays. The ventrals have three rays; the teeth are conic, and placed in a single row along the sides of the jaws, but in several in front; the palate is without teeth. Their dorsal, anal, and caudal fins are united, although the first named experiences a great depression.

The viviparous blenny (*B. viviparus*) is a well-known species, and has been long celebrated for a peculiarity which is chiefly observable among cartilaginous fishes, that, namely, of producing its young alive. These are so matured at the time of their birth, that on their first exclusion they swim about with the utmost agility. No fewer than 200 or 300 young are sometimes produced by an individual, and the abdomen of the mother is so distended before parturition, that it is impossible to touch it without causing them to be extruded. Full-grown individuals seldom exceed twelve inches in length; the body is slender and smooth; the colour yellowish olive, pale beneath, and marked on the upper parts with dusky spots. It is a littoral fish, and of frequent occurrence under stones. When boiled, the back-bone acquires a green colour. America produces a much larger species, which sometimes exceeds the length of three feet. It has been described under the name of *Blennius lubrosus*.

GENUS *ANARRHICHAS*, Linn. Bear so much affinity to the blennies, that the species have been termed by Cuvier Blennies without ventrals. The dorsal fin, entirely composed of simple rays, but without stiffness, begins at the nape, and extends, in common with the anal one, nearly to the caudal fin, which is rounded like the pectorals. The whole body is smooth and covered with mucus. Their palatines, vomer, and mandibles, are armed with large osseous tubercles, which are crowned with small enamelled teeth; but the anterior teeth are longer and conical. Such a conformation of the teeth makes them very powerful instruments, and these fishes, from their large size, are thereby rendered ferocious and dangerous. They have six rays in the gills; the stomach is short and fleshy, with the pylorus near its base; the intestine short, thick, and without cæca; and the swimming bladder is wanting.

The most common species is the *A. lupus*. Plate CCCIV. fig. 2. It is of frequent occurrence in most of the northern seas, and is well known along the coasts of Britain by the names of *sea-wolf* and *sea-cat*. Its ordinary length is from three to four feet, but examples sometimes occur nearly double that size. The colour is obscure livid brown, with

VOL. XII.

several transverse stripes or bands of a darker hue. The dorsal fin, as already mentioned, extends along the whole length of the back, and is composed of seventy-three rays. The fore teeth project considerably, and diverge a little from each other, forming a powerful kind of armature, moved by jaws of such strength that the animal has been known to imprint the marks of its teeth on a bar of iron. The uninviting aspect of this fish has probably not been without influence in producing a prejudice against it as an article of food. Its flesh, however, is far from being unsavoury, and bears considerable resemblance to that of the eel. It is in great request among the Icelanders, who eat it dry and salted; while the other parts of the fish are likewise converted to useful purposes, the skin forming shagreen, and the gall being used as soap.

The gobies (*Gobius*, Linn.) are at once distinguished from their associates by having their thoracic ventrals united, either throughout their whole length, or only towards the base, and forming a single hollow disk, more or less tunnel-shaped.

The spines of their dorsal fins are flexible; the opening of the gills, provided there are only five branchial rays, is generally very small; and, like the blennies, they can live for some time out of the water. Their stomach is without a *cul-de-sac*, and the intestinal canal has no cæca: the males have an appendage, like the blennies, behind the anus; and some species are known to produce their young alive. They are small or middle-sized fishes, and usually frequent rocky places near the margin of the waters which they inhabit. The greater number are provided with a simple air-bladder.

GENUS *GOBIOUS*, Cuv. Includes the gobies properly so called. They have their ventrals united throughout their whole length, and even anterior to their base, by a traverse, so as to form a concave disk. Their body is elongated; the head of moderate size, and rounded, the cheeks inflated; and the eyes placed near each other. The back bears two fins, the posterior one rather long. Several species occur in European seas, the characters of which have not been sufficiently examined. They frequent waters having a clay bottom, and pass the winter in excavations which they make for that purpose. In the spring they prepare a kind of nest in places which abound with Fuci, and cover it with the roots of the *Zostera*: the male remains there waiting the arrival of the females, which come in succession to deposit their eggs. These he fecundates, and afterwards watches and defends courageously.

The black goby (*Gobius niger*, Linn.) is not a scarce species on the coasts of Britain. It is about five inches long, of a dark-brown colour above, and white beneath, variegated with darker spots and stripes. The tail is rounded, and the superior rays of the pectorals are free at the extremity. Several others are found in the Mediterranean, such as *G. jozzo*, *G. capito*, and *G. cruentatus*. A few are inhabitants of fresh waters, such as the small dark-coloured species described by Bonelli under the name of *G. fluviatilis*. Among foreign kinds the most remarkable are the *Cottus macrocephalus* of Pallas, in which the head is unusually large; and the *G. lunceolatus* of Bloch, distinguished by its elongated form, and pointed caudal fin.

The genus named *Gobioides* by Lacépède differs from the gobies only in having their dorsals united so as to form a single fin, and in the body being more elongated. The *Tenioides* of the same distinguished Ichthyologist have likewise a continuous dorsal line, and the body is still more lengthened. These fishes present a very peculiar aspect, in consequence of having their upper jaw very short, and the lower one high and convex, rising above it, both of them being armed with long crooked teeth, while the eye is reduced to a mere point, and en-

Acanthop-
terygii.
Gobioidæ.

tiely concealed under the skin. The cavity of the mouth is filled with a fleshy tongue almost of a globular shape, and the lower jaw has a few barbels beneath. The *Tænioides Hermanii* is the only species known: it is a native of the East Indies, and is usually found in the mud of stagnant waters.

GENUS PERIOPHTHALMUS, Schn. Contains such as have the head entirely scaly, the eyes placed quite close to each other, and furnished on their lower margin with an eye-lid capable of covering them; the pectoral fins clothed with scales for more than half their length, which makes them look as if supported by a kind of arm. Their gills being still narrower than those of the other gobies, they can live for a longer period out of the water; and in the Moluccas, their native country, they are often observed to leap out on the mud in order to escape their enemies, or to seize the small shrimps, which form their principal nourishment. In some the ventrals have a concave disk like the gobies properly so called; while in others these fins are separated almost to the base. Plate CCCIV. fig. 3.

GENUS ELEOTRIS, Cuv. In common with the gobies, the fishes referred to this genus have the first dorsal with flexible spines, and an appendage behind the anus; but the ventrals are perfectly distinct, the head obtuse and a little depressed, the eyes remote from each other, and the branchial membrane with six rays. The lateral line is faintly marked, and the viscera resemble those of the *Gobii*. The greater proportion of the species live in fresh water, and often in the mud. That named *E. dormitatrix* is a native of the Antilles; it is of considerable size, with the head depressed, the cheeks dilated, and the fins spotted with black. Others occur in Senegal and the Indies, and a small gilded species, marked with a black spot at the base of the pectoral (the *Gobius auratus* of Riss.), inhabits the coasts of the Mediterranean.

GENUS CALLIONYMUS, Linn. Possesses very strongly marked characters in the gills being open only by a hole on each side of the nape, and in the ventral fins being placed under the throat, remote, and larger than the pectorals. The head is oblong and depressed, the eyes approximating when seen from above, the inter-maxillaries very protractile, and the pre-opercles elongated behind and terminating in a few spines. The teeth are crowded, and are wanting on the palate. They are beautiful fishes, with a smooth skin, and having the anterior dorsal supported by some setaceous rays, occasionally much elevated. The second dorsal is elongated, as well as the anal. The same appendage is observable behind the anus as in the preceding genera. The stomach is not in the form of a *cul-de-sac*, and they are without cæca and air-bladder. Of this handsome genus we may mention as an example the gemmeous dragonet (*C. lyra*), which occurs not unfrequently in the British seas. Plate CCCIV. fig. 4. It derives its specific name from the form of the dorsal fin, which has been thought to bear an obscure resemblance to a lyre. The full-grown fish is about a foot in length. It is of a beautiful orange or yellow colour, spotted and striped with violet; the pupils of the eyes fine deep blue, and the pectoral fins light brown. The sordid dragonet (*C. dracunculus*) differs from the above only in having the dorsal fin short and without a fillet: by many it is conjectured to be the female of *C. lyra*. Several species inhabit the Mediterranean, such as *C. lacerta*, *cithara*, *jaculus*; and not a few are found in foreign countries.

GENUS TRICHONOTUS, Schn. Differs from the typical *Callionymi* only in having the body very much elongated, and the continuous dorsal and anal of proportionate extent. The genus COMEPIHORA of Lacépède comprehends but one species, from the Lake Baïkal, which is

usually found dead after storms, and is of so soft and fat a substance as to afford a considerable quantity of oil. It is distinguished from all the other members of this group by being destitute of ventrals. The genus PLATYTERON is constituted by a few Indian fishes, which, to the large and remote ventrals of the *Callionymi*, unite a short depressed head, a small mouth, open branchiæ, and large scales: their two dorsals are short and remote.

GENUS CHIRUS, Steller (*Labrax*, Pallas). Placed by Cuvier at the end of this family, presents so many distinctive characters, that it may not improperly be regarded as the type of a new family group. The body is elongated, and garnished with ciliated scales; the head small and unarmed; the mouth but slightly cleft, and furnished with small unequal conical teeth; the spines of the dorsal are almost invariably slender, and that fin extends along the whole back. But their most distinctive feature consists of numerous series of pores, resembling several lateral lines. Their intestines are without cæcal appendages; they have often a tuft on the eye-brow, like certain kinds of blenny; but their ventrals are composed of five soft rays, as is usual in the allied species. All the known kinds, amounting to six or seven in number, are from the sea of Kamschatka, and were first described by Pallas in the 11th volume of the Memoirs of the Academy of Petersburg for 1810.

FAMILY XIII.—PECTORALES PEDICULATI.

This family, in Baron Cuvier's arrangement, comprehends such acanthopterygenous species as have the carpal bone prolonged in order to form a kind of arm, which supports the pectorals. From this peculiarity they have derived their family name. Only two genera are here included, and these are closely allied to each other, although the generality of authors have placed them widely apart.

GENUS LOPIHUS, Linn. Besides the semi-cartilaginous nature of the skeleton, and the want of scales on the skin, has for its general character pectorals supported as if by two arms, each of them sustained by two bones, which have been compared to the radius and cubitus, but which in reality belong to the carpus, and are more elongated in this genus than in any other. The ventrals are placed greatly in advance of the pectorals, and the opercles and rays of the branchiæ are enveloped in the skin, while the gills open only by a single hole, pierced behind the pectorals. The species are voracious; they have a large stomach and a short intestine, and are able to live for a very long period out of the water, on account of the small opening of their gills. The kinds now included in this genus, in the restricted sense attached to it by Cuvier, have the head excessively large in proportion to the rest of the body, and at the same time broad and depressed, and spiny in many places; the opening of the mouth very wide, and armed with pointed teeth; and the lower jaw furnished with numerous barbels. There are two distinct dorsals, of which the anterior possesses some detached rays, moveable over the head, where they rest on a horizontal inter-spinal; the branchial membrane forming a very large sac opening in the axilla, and supported by six very long rays; the operculum small. It is asserted that they lie among the mud, and by putting in motion the rays of their head, attract small fishes, which, mistaking the broad and fleshy extremities of these rays for worms, thus become the prey of the Lophii. It is also said that they can seize and retain their prey by means of their large branchial sacs. Their intestine has two very short cæca towards its origin, and the swimming bladder is wanting. Of these fishes, the most remarkable is the *Lophius piscatorius* of Linnæus. Plate CCCIV. fig. 5. It

Acanthop-
terygii.
Pectorales
Pediculati.

Acanthopterygii.
Labridæ. is a large fish (measuring from four to five feet in length) of the European seas, with a wide mouth, depressed head, numerous teeth, and a bearded tongue. Its aspect is extremely repulsive. The *Mountsbay Angler* of Borlase,¹ and the one from Bristol,² are, according to Dr Fleming, only mutilated specimens of the species just alluded to.

The *CHIRONECTES* (*Antennarius*, Commers.) have free rays on the head, like the preceding, the first being slender, often terminating by a tuft; and the following, increased by a membrane, are sometimes greatly inflated, and at other times united into a single fin. Their body and head are compressed, and the mouth opens vertically; their gill-covers, provided with four rays, open only by a canal, and a small hole behind the pectoral; the dorsal occupies nearly all the back. The whole body is sometimes garnished with cutaneous appendages. The branchiæ are four in number; the swimming bladder is large, and the intestine of moderate size and without cæca. By filling their enormous stomach with air, after the manner of the Tetrodons, they can inflate their abdomen like a balloon. When on land, their fins assist them in creeping, which they do almost after the manner of small quadrupeds, the pectorals, from their position, performing the office of hinder legs. Moving about in this manner, they can live without entering the water for two or three days. They are found in tropical seas; and Linnæus appears to have confounded several species under the name of *Lo-phius histrio*.

GENUS *MALTHE*, Cuv. Has the head unusually large and flattened, principally by the projection of the sub-operculum: the eyes placed very far forwards; the muzzle projecting like a little horn, and the mouth situate under it, the latter being of moderate size and protractile; the gill-covers supported by six or seven rays, and open towards the back by a hole above each pectoral; the single dorsal small and soft; the body covered with osseous tubercles, and having barbels along the sides, but there are no free rays over the head. The swimming bladder and cæca are wanting.

GENUS *BATRACHUS*. Derives its name from a Greek word signifying a frog, to which the species are thought to bear some resemblance, in consequence of the enlargement of the head. The latter is flattened horizontally, and wider than the body; the gape wide, and both the opercle and sub-opercle spiny; the gill-covers six-rayed; the ventrals narrow, attached under the throat, and consisting only of three rays, of which the first is wide and elongated; and the pectorals supported by a short arm, formed by the prolongation of the carpal bone. The first dorsal is short, supported by three spiny rays; the second long and soft, which is also the case with the corresponding anal one. The lips are often garnished with filaments. Such as have been dissected have their stomach in the form of an oblong sac, the intestines short and without cæca. The swimming bladder is deeply furcate anteriorly. They conceal themselves in the sand, lying in ambush for their prey. The wounds made by their spines are supposed to be dangerous. The species, which vary considerably in their form and aspect, occur both in the Pacific and Atlantic Oceans.

FAMILY XIV.—LABRIDÆ.

Easily recognised by its external aspect. The body is oblong and scaly, and the single dorsal fin is supported anteriorly by spines, each of which is generally garnished with a membranous appendage. The jaws are covered

by fleshy lips; the two upper pharyngeals are supported against the cranium, and the lower one is large, all the three armed with teeth, sometimes *en pavé*, at other times pointed or in the form of plates, but generally stronger than usual. The intestinal canal is entirely without cæca, or only with two very small ones; and there is a strong swimming bladder.

The genus *LABRUS* of Linnæus forms an extensive group of fishes, very like each other in their oblong shape, and double fleshy lips (from which circumstance they derive their name), one of which is immediately connected with the jaws, and the other with the sub-orbitals; the gills are serrated, and have five rays; the maxillary teeth conic, the middle and anterior ones being longest; the pharyngeal teeth cylindrical and blunt, disposed *en pavé*, the superior on two large plates, the inferior on a single one corresponding to the two above. The stomach is not in the form of a cul-de-sac, but is continuous with an intestine without cæca, which, after two convolutions, terminates in a large rectum. The swimming bladder is robust and simple. The species are numerous, and the colours of many of them liable to so much variation that it is difficult to distinguish them with precision.

In recent times the Linnæan genus has been subdivided as follows:

GENUS *LABRUS*, properly so called. Opercle and pre-opercle destitute both of spines and dentations; cheeks and opercle covered with scales; lateral line straight, or nearly so.

Four different kinds have been described as inhabiting the British seas, but some of these seem to be mere varieties, such, for example, as the *L. balanus* and *L. comber* of Pennant, which are probably referrible to the *Labrus maculatus* of Bloch. *L. lineatus* is likewise a British species. The ground colour is reddish, with one or more irregular clouded bands of a deeper colour along the flanks. The dorsal has from sixteen to seventeen spines, and is marked with a dark-coloured spot anteriorly.

GENUS *CHEILINUS*, Lacép. Differs from the *Labri* properly so called, by the lateral line being interrupted opposite the dorsal fin, and commencing again a little lower. The scales at the extremity of the tail are large, and partially envelope the base of the caudal. They are fishes of considerable beauty, and are found in the Indian seas.

The next genus of interest is that named *JULIS*, in which the head is entirely smooth and without scales, and the lateral line is much bent opposite the end of the dorsal. Several species occur in the Atlantic and Mediterranean, and most of them are of very beautiful colours. The most common European one (*Labrus Julis*, Linn.) is frequent in the Mediterranean, and has likewise been found on the coast of Cornwall. It is about seven inches in length, and of a beautiful violet, relieved by a bright zigzag orange band on each side.

GENUS *CRENILABRUS* has been separated by Cuvier from the *Lutjani* of Bloch, and associated with the *Labri*, to which all their characters, both external and internal, correspond, except the dentation of the edge of the pre-opercle. (See Plate CCCIV. fig. 6.) Several species are found in the northern seas, such as *Lutjanus rupestris*, Bloch, 250, of a yellow colour, with clouded vertical bands. The British species (*C. tinca*) known under the name of *old wife*, or *wrasse*, belongs to this genus, as does likewise the *gibbous wrasse* of Pennant's *British Zoology*. The Mediterranean furnishes a great number adorned with the most beautiful colours, such as the *Labr. lapina*, Forsk., which is silvery, with three broad longitudinal

¹ Cornwall, 266, t. 27, f. 6.

² Phil. Trans. liii. p. 170, t. 13.

Acanthop-
terygii.
Labridæ.

bands formed by dots of vermillion; the pectorals yellow, and the ventrals blue. Many likewise occur in tropical countries, of which we may mention *Lut. verres* (Bl. 255), *Lut. notatus*, *L. virescens*, and *L. chrysops*.

To the characters of the *Crenilabri*, the genus *CORICUS* of Cuvier joins that of a mouth nearly as protractile as in the *Epibuli*. The latter group are very remarkable for this property, being capable of extending it to a great length, and suddenly forming it into a kind of tube by a peculiar movement of the maxillaries. They practise this artifice to seize small fishes as they swim within reach of this singular instrument. Several allied genera avail themselves of the greater or less protractility of their jaws to procure their food in a similar manner.

The whole body, and the head of the *Epibuli*, are covered with large scales, the hinder row of which encroaches even on the anal and caudal fins, as likewise takes place among the *Cheilini*. The lateral line is interrupted in a similar manner, and, in common with these last-named fishes, and the *Labri*, they have two long conical teeth in front of each jaw, and behind them small blunt ones. Those of the pharynx have not been observed. The *Sparus insidiator* of Pallas is the only species hitherto discovered. It is of a reddish colour, and found in the Indian Ocean.

GENUS *CLEPTICUS*. Furnished with a small cylindrical muzzle, which rises suddenly like that of the *Epibuli*, but is not so long as the head, and scarcely permits the view of a few small teeth; the body is oblong, the head obtuse, the lateral line continuous, and the scales envelope the dorsal and anal fins, almost as far as the summit of the spines. The only ascertained species (*C. genizara*) is of a reddish purple colour, and inhabits the Antilles.

GENUS *ELOPS*, Commers. *Gomphosis*, Lacép. Has the head entirely smooth, as in *Julis*, but the muzzle is in the form of a long and slender tube, formed by the prolongation of their inter-maxillaries and mandibularies, which the integuments bind together as far as the small opening of the mouth. Of these fishes, the *Gomphosis cæruleus*, and *G. variegatus*, Lacép., may serve as examples. They are taken in the Indian seas, and many of them are said to form a delicious article of food. The preceding genera, from *Labrus* properly so called inclusive, may be all regarded as Linnæan *Labri*. We now come to

GENUS *XIRICHTHYS*, Cuv. Which comprehends fishes resembling the *Labri* in form, but they are very much compressed, and the forehead descends suddenly towards the mouth by a deep and nearly vertical line, formed by the ethmoid and the ascending branches of the inter-maxillaries. The body is covered with large scales; the lateral line interrupted; the jaws armed with a row of conical teeth, of which the medial ones are longest, and the pharynx paved with hemispherical teeth; the intestinal canal is continuous, with two convolutions, and no cæca, nor is the stomach in the form of a cul-de-sac. They possess a pretty large air-bladder.

Naturalists, anterior to the time of Cuvier, ranged the species with the *Coryphææ*, from which they greatly differ in their structure, internal as well as external. They approximate to the *Labri*, to which, however, they are dissimilar in the profile of the head.

GENUS *CHROMIS*, Cuv. Has the lips and protractile inter-maxillaries, the pharyngeal bones, and dorsal filaments, of the *Labri*; but the teeth are *en carde* upon the jaws and pharynx, with an anterior range of a conical shape. The vertical fins are filamentous, and even those of the abdomen are often prolonged into long filets, and the lateral line is interrupted. The stomach is a cul-de-sac, but there are no cæca. One small species, of a chestnut-brown colour (*Sparus chromis*), is found in immense numbers in the Mediterranean. The Nile produces another, which attains the length of two feet, and is regarded as

the best fish occurring in Egypt. It is the *Labrus Niloticus* of Hasselq. and Sonnini. The genus *CYCHLA* differs from the preceding by having all the teeth crowded, and placed in a broad band, and by the body being more elongated. *PLESTOPS*, Cuv., has the head compressed, the eyes near each other, and the ventrals very long. *MALACANTHIUS* possesses the general characters of the *Labri*, and the maxillary teeth are also similar to theirs, but those of the pharyngeals are *en carde*; the body is lengthened, the lateral line continuous, the opercle terminated by a small spine, and the long dorsal has only a small number of slender, flexible, anterior spines. One species is found in the Antilles, of a yellowish colour, irregularly rayed across with violet; it is the *Coryphæna plumieri*, Lacép. iv. viii. 1.

GENUS *SCARUS*, Linn. Comprehends fishes very remarkable on account of the form of the jaws (that is, their inter-maxillary and pre-mandibular bones), which are convex, rounded, and garnished with teeth like scales upon their edges and anterior surface; these teeth succeed each other from behind forwards, so that those of the base are the newest, and in time come to form a range upon the cutting edge. Naturalists have erroneously thought that the jaw-bones themselves were naked or exposed. These jaws are, besides, covered while the fish is alive by fleshy lips, but there is no double lip adherent to the sub-orbitaries. The species have the oblong form of *Labrus*, with large scales, and the lateral line interrupted; they bear on their pharynx two plates above and one below, garnished with teeth like the pharyngeal plates of the *Labri*, but these teeth are in the form of transverse laminæ, and not *en paré*.

Cuvier is of opinion that the *Scarus creticus* of Aldrovandus is the species so celebrated under the name of *Scarus* by the ancients, and in search of which (in the time of Claudius) Elipertius Optatus, the commander of the Roman fleet, went to Greece, with a view to effect its introduction to the Italian seas. It is still used in our days as an article of food in Greece. The species are numerous in the seas of warm climates, and are vulgarly known, on account of the peculiar form of the jaws, and the splendour of their colours, under the name of parrot fishes.

FAMILY XV.—FISTULARIDÆ.

Characterised by a long tube formed in front of the cranium, by the prolongation of the ethmoid, the vomer, the pre-opercles, inter-opercles, &c. at the end of which the mouth is placed, composed, as usual, of inter-maxillaries, maxillaries, palatines, and mandibularies. The intestine is without any considerable inequalities, or many convolutions, and their ribs are either short or wanting. Some of them (the *Fistulariæ*) have the body cylindrical, others (the *Centrisci*) have it oval and compressed.

GENUS *FISTULARIA*, Linn. Acquires its name from the long tube common to all the family. The jaws are at the extremity, opening but little, and nearly in a horizontal direction. The head, thus elongated, composes a third or fourth part of the whole body, which is itself long and slender. There are six or seven rays in the gills; the osseous appendages likewise extend behind the head to the anterior part of the body, which they tend more or less to strengthen. The dorsal corresponds to the position of the anal, and the stomach, in the form of a fleshy tube, is continuous with a narrow canal, without folds, at the commencement of which there are two cæca. In *FISTULARIA* properly so called, there is only one dorsal, which, as well as the anal, is composed chiefly of simple rays; the inter-maxillaries and lower jaw are armed with small teeth;

Acanthop-
terygii.
Fistula-
ridæ.

Malacop-
terygii
Abdomi-
nales.
Cyprinidæ.

Malacop-
terygii
Abdomi-
nales.
Cyprinidæ.

and between the lobes of the caudal there issues a filament sometimes as long as the whole body; the tube of the muzzle is very long and depressed, the swimming bladder excessively large, and the scales invisible. In the subdivision called *AULOSTOMA* by Lacépède, a name derived from *αὐλός*, a flute, and *στόμα*, the mouth, the dorsal is preceded by numerous free spines, and the jaws are without teeth. The body, which is very scaly, is broad, and compressed between the dorsal and anal, the latter followed by a short, small tail, terminated by the usual fin. The tube of the muzzle is rather short, large, and compressed; the swimming bladder very large. We are acquainted with only one species (*Fistularia chinensis*, Bl.), which is found in the Indian seas.

The *CENTRISCUS* of Linn. possess the tubular trunk of this family; the body, however, is not elongated, but oval or oblong, compressed laterally, and sharp on the under side; the gills have only two or three slender rays; the first dorsal is spiny, and the small ventrals are placed behind the pectorals. The mouth is extremely small, and opens obliquely; the intestines are without cæca, folded three or four times; and the swimming bladder is of considerable size. In *CENTRISCUS* properly so called, the anterior dorsal, which is placed very far forwards, has its first spine long and strong, supported by an apparatus connected with the shoulder and head. The species are covered with small scales, and have several broad and denticulated plates on the apparatus just mentioned. The *C. scolopax*, or trumpet-fish, is a very common species in the Mediterranean, about five inches long, and of a silvery lustre. (See Plate CCCIV. fig. 7.) It occurs occasionally on the south-western coasts of England. In the sub-genus *AMPHISILE*, the back is defended with large scaly pieces, of which the anterior spine and the first dorsal have the appearance of being a continuation. All the species hitherto known to us are from the Indian seas: we may mention as examples, *Centriscus scutatus*, Linn., and *Centriscus velitaris*, Pallas.

We here terminate our abstract of the *ACANTHOPTERYGII*, or first great order or division of the ordinary fishes.

The second division of common fishes, or that named *MALACOPTERYGII*, contains within itself three orders, which admit of being characterised by the position of the ventrals, or, in certain cases, by their absence.

ORDER II.¹—MALACOPTERYGII ABDOMINALES.

These are distinguished by having their ventrals suspended to the under part of the abdomen, and behind the pectorals, without any attachment to the shoulder bone. This is the most numerous of the three orders, and includes a large proportion of the fresh-water fishes. It is divisible into five families.

FAMILY I.—CYPRINIDÆ.

May be known by having the mouth but slightly cleft, the jaws weak and generally without teeth, and their edge formed by the inter-maxillaries; by pharyngeals strongly toothed, thus compensating for the imperfect armature of the jaws; and by the branchial rays being few in num-

ber. Their body is scaly, and there is no adipose dorsal, such as is observed in Siluri and salmon. Their stomach has no cul-de-sac, and the pylorus is without cæcal appendages. They are the least carnivorous of fishes.

The typical genus *CYPRINUS* is a very natural one, and comprehends a great number of species, which are readily distinguished by the small mouth, toothless jaws, and the three flat branchial rays. Their tongue is smooth, and the palate provided with a soft and singularly irritable substance, vulgarly known by the name of *Carp's tongue*. The pharynx presents a powerful instrument for mastication, consisting of large teeth attached to the inferior pharyngeal bones, and capable of pressing the food between them, and a stony disk enclosed in a wide cavity under an apophysis of the basilar bone. These fishes have only one dorsal, and the body is covered with scales, most frequently of large size. They inhabit fresh waters, and are perhaps the least carnivorous of their class, subsisting chiefly on grains, grass, and even on mud. Their stomach is continuous, with a short intestine without cæca, and the bladder is divided into two by a constriction.

The genus *CYPRINUS*,² Cuv. including the *Carp*s properly so called, has a long dorsal, which, as well as the anal, has a spine for the second ray. Of these, some have barbels at the angles of the upper jaw, and others are destitute of these appendages. Of the former we may cite as an example the common carp; and the gold fish of China affords an instance of the latter.

Cyprinus carpio, the common carp. This well-known fish is of an olive-green, yellowish beneath, having the anal and dorsal spines strong and denticulated, and the barbels short; the pharyngeal teeth are flat and striated on the crown. It is a native of the central countries of Europe; but, owing to its value as an article of food, it was early distributed by human agency over the whole of that Continent. The ease with which it can be transported from one place to another, and its speedy growth and propagation in ponds and artificial reservoirs, afforded great facilities for its rapid dispersion. The year 1614 is assigned as the date of its first introduction into England; but it was naturalized in Germany and Sweden nearly half a century before that period. It delights in tranquil waters, preferring such as have a muddy bottom, and the surface partially shaded with plants. Its food consists of the larvæ of aquatic insects, minute Testacea, worms, and the tender blades and shoots of plants. The leaves of lettuce, and other succulent plants of a similar kind, are said to be particularly agreeable to them, and to fatten them sooner than any other food. Although the carp eats with great voracity when its supply of aliment is abundant,—to such a degree, indeed, as sometimes to produce indigestion, which occasionally proves fatal,—it can subsist for an astonishing length of time without nourishment. In the winter, when they assemble in great numbers, and bury themselves among the mud and the roots of plants, they often remain for many months without eating. They can also be preserved alive for a considerable length of time out of the water, especially if care be taken to moisten them occasionally as they become dry. Advantage is often taken of this circumstance to transport them alive, by packing them among damp herbage, or wet linen; and the operation is said to be unattended with any risk to the animal, especially if the precaution be taken to put a piece of bread in its mouth steeped in brandy! In a similar way, the Dutch preserve them by suspending them from the roof of a damp apartment in a bag-net filled with moss, which is continually kept moist,

¹ Of the general CLASS of Fishes.

² The name is of Grecian origin, and was applied to the species because they were dedicated to Venus, in consequence of their extraordinary fecundity.

Malacop-
terygii
Abdomi-
nales.
Cyprinidæ.

and they are fed with vegetables and bread steeped in milk,—a mode of treatment by which they are not only kept alive, but actually thrive and fatten.

The fecundity of these fishes is very great, and their numbers consequently would soon become excessive, but for the many enemies by which their spawn is destroyed. No fewer than 700,000 eggs have been found in the ovaria of a single carp, and that too by no means an individual of the largest size. Their growth is very rapid, more so perhaps than that of any other fresh-water fish, and the size which they sometimes attain is very considerable. In certain lakes in Germany and Prussia, individuals are occasionally taken weighing thirty or forty pounds; and Pallas relates that they occur in the Volga five feet in length, and even of greater weight than the examples just alluded to. The largest of which we have any account is that mentioned by Bloch, taken near Frankfort-on-the-Oder, which weighed seventy pounds, and measured nearly nine feet in length.

Cyprinus auratus (gold fish). This beautiful species, the most brilliantly adorned of all our fresh-water fishes, and scarcely surpassed even by the more richly ornamented inhabitants of the ocean, is well known to be a native of China, although it is now domesticated, so to speak, in almost every country, both of the old and new world. Like the carp, it has the dorsal and anal spines denticulated. When young it is of a blackish colour, and it gradually acquires the fine golden red by which it is characterised; but some examples are of a silvery hue, and others are variegated with three different shades of colour. Like most other animals that have been long estranged from their natural habits, and subjected to artificial influences, this species presents a great many varieties, extending even to some important parts of structure. Individuals occur without a dorsal, others with a very large one, others with the caudal greatly enlarged, and divided into three or four lobes; and in some instances the eyes are enormously dilated.¹ The golden carp is said to have been originally confined to a lake near the mountain *Tsienking*, in the province of *The-kiang*, in China, about the 30th degree of N. lat. It was first brought to England in 1691, but was very scarce till 1728, when a considerable number were imported, and they soon became generally known. They do not flourish in rivers and open ponds, not, however, because such places are uncongenial to them, but because they are exposed to many enemies, against which they have no means of defence. When kept in confinement they ought to be nourished with fine crumbs of bread, small worms, flies, and yolks of eggs dried and powdered, and the water ought to be frequently changed. The ordinary length of this species is from four to six inches; but they have been sometimes known to reach a foot. Although natives of a warm climate, they can sustain a great degree of cold uninjured. An individual, which was accidentally exposed during the night, was completely frozen up in the centre of its glass jar; but as the ice thawed it recovered its vigour, and seemed to suffer no further inconvenience.

To this group belongs the smallest of the European Cyprini, viz. *C. amarus*, which is about an inch long, greenish above, and of a fine red beneath. During the time of spawning, which takes place in April, it has a steel-blue line on each side of the tail; the second dorsal ray forms a rather stiff spine.

GENUS BARBUS of Cuvier, contains such species as have the dorsal and anal short, with a strong spine for the second or third ray of the dorsal, and four barbels,

two of which are at the extremity, and two at the angles of the upper jaw. As an example, we may refer to the *Cyprinus barbatus*, or barbel, which may be known by its oblong head. It is very common in clear and running waters, where it sometimes attains to a length exceeding ten feet. Several allied species are found in Italy, having the spine weaker, but which, nevertheless, differ from the following genus by possessing four barbels. Such are *Barbus caninus*, Bonelli; *B. plebeius*, Val.; *B. equeus*, Id. Various species of Barbi occur in the Caspian Sea, in the Nile, and in India; and not a few have been ascertained to inhabit America.

GENUS GOBIO, Cuv. Has the dorsal and anal short, both of them without spines, and the mouth furnished with barbels. Of this genus the gudgeon (*Cyprinus gobio*) may be cited as an example. It is a small fish, seldom exceeding seven or eight inches, and is found in most parts of Europe in small lakes and gently flowing rivers. It is of a pale olive-brown colour, slightly spotted with black, especially on the fins, the sides and abdomen being silvery white. It spawns in the spring, and as it deposits its ova at distant intervals, the operation generally continues for a considerable time. It is a very prolific fish; and as its flesh is of a very delicate flavour, it is much sought after for the table.

GENUS TINCA, Cuv. Unites to the characters of the gudgeons that of having very minute scales; their barbels also are very small. This genus includes the common tench (*Cyprinus tinca*, L.), which is of a deep yellowish brown, sometimes, however, assuming a fine golden colour. Its usual length is from twelve to fourteen inches; but instances are on record of its having reached three feet. It inhabits stagnant waters with a muddy bottom; and in the winter conceals itself among the mud, and seems to undergo a kind of torpidity. In May and June it deposits its ova among aquatic plants; these are very minute, of a green colour, and so numerous that 297,000 have been reckoned in one female. The tench is very extensively distributed, appearing to occur throughout the whole globe. Its flesh is not much esteemed, as it is soft, insipid, and difficult of digestion.

GENUS ABRAMIS, Cuv. Distinguished by wanting spines and barbels; the dorsal is short, placed behind the ventrals, and the anal long. Two species are known, the common bream (*Cyp. brama*), and the little bream (*Cyp. blicca*, C. latus, Gm. Bl. 10). The former is the largest fish in this subdivision; there are twenty-nine rays in the anal, and all the fins are obscure. It is common in slow flowing rivers and lakes in most European countries. It sometimes acquires two feet and a half in length, but its ordinary dimensions may be stated to be about a foot. Worms, confervæ, and aquatic plants are its usual food; but, like many allied species, it often swallows mud, which renders its flesh unsavoury. "There exists in the river Trent, in the neighbourhood of Newark, two species or varieties of bream. The common bream, *Cyprinus brama*, is known there by the name of Carp Bream, from its yellow colour, and has been taken of nearly eight pounds weight. The other species or variety, which I believe to be a non-descript, never exceeds a pound in weight. It is of a silvery hue, and goes by the name of White Bream."²

Omitting the genera LABEO and CATASTOMUS, of which the species are all foreign, and imperfectly known, we now come to the generic group named LEUCISCUS (Klein), comprehending several kinds indigenous to Europe. They have the dorsal and anal short, and are destitute of spines and barbels, and there is nothing particu-

Malacop-
terygii
Abdomi-
nales.
Cyprinidæ.

¹ The varieties of this species have afforded materials for a kind of monograph by Sauvigny, and a painter of the name of Martinet.

² *Linn. Trans.* xiv. p. 587.

Malacop-
terygii
Abdomi-
nales.
Cyprini-
dæ.

Malacop-
terygii
Abdomi-
nales.
Esocidæ.

lar in the structure of the lips. The species of this sub-division are considerable in amount, but they are held in little estimation as articles of food. They are distinguished by the position of the dorsal, a character, however, which is not always sufficiently defined. In some it corresponds to the position of the ventrals; such is the case with *Leuc. dobula* (*Cyprinus dobula*, Linn.), in which the head is broad, the muzzle rounded, and the pectorals red. *Leuc. rutilus* (the roach), has the body compressed and silvery, and all the fins red. In others, the dorsal corresponds above to the interval which is between the ventrals and the anal. This is exemplified in *Leuc. alburnus* (the bleak), in which the body is narrow, and of a brilliant silvery hue; the fins pale; the forehead straight, and the inferior jaws somewhat elongated. It is common throughout Europe; and is one of the fishes whose nacre (or silvery-looking substance) is employed in fabricating artificial pearls. *Leuc. phoxinus* (common minnow) likewise pertains to this group. The appearance of this beautiful little fish is familiar to all. It is the smallest species of the genus found in Europe, the greatest length which it attains seldom exceeding three inches. It first makes its appearance in March, and disappears in October, passing the winter beneath the mud. It is well known to be a gregarious species, and small shoals are to be found in almost every shallow stream, especially in clear weather, as they seem to delight in warmth and sunshine. They usually spawn in the month of June, but their ova are often found at a much later period. The flesh of the minnow is delicate and well flavoured, but its size is too small to admit of its being of much value as an article of food. It is principally used as a bait for the capture of larger kinds.

Certain species of the present genus (the Chelæ of Buchanan) have the dorsal corresponding to the commencement of the anal, and in several of these the body is compressed nearly in the same manner as in some of the *Clupeæ*. Such is *Leuc. cultratus*, which is further remarkable for its lower jaw, which ascends in front of the upper, and for its large pectorals shaped like a scythe.¹ The generic group *GONORHYNCHUS*, Gronov. is dissimilar from all the other Cyprini, by having the body and the head elongated, and covered, as well as the opercula, and even the membrane of the branchiæ, with small scales; the muzzle projecting in front of the mouth, which is small, and without teeth or barbels; three branchial rays, and a small dorsal above the ventrals. Only one species is known (*Cyprinus gonorhynchus*, Gm.), which is found at the Cape of Good Hope.

GENUS COBITIS (loach). Has the head small, the body elongated, clothed with scales, and covered with a mucous matter; the ventrals placed behind, and above them a small single dorsal; the mouth at the end of the muzzle, but little cleft and without teeth, but surrounded with lips fitted for sucking, and by barbels; gill-covers little opened, and having only three rays. Their inferior pharyngeal bones are rather strongly dentated, their intestines are without any cæca, and their swimming bladder, which is very small, is enclosed in an osseous bilobate case, attached to the third and fourth vertebræ. Three species are found in the fresh waters of Europe, viz. *C. barbutula*, *C. fossilis*, and *C. tænia*. The first of these, the bearded loach, is a well-known fish in this country, as it occurs plentifully in almost every small stream. It is about four or five inches long. The second species, which does not occur in Britain, measures sometimes a foot in length. It dwells in the mud of ponds, and is so tenacious of life as to live a long time after being stiffly frozen, or even dried. In stormy weather it rises to the surface

and agitates the water. It swallows quantities of air, which it converts, according to M. Ehrman's observations, into carbonic acid. Its flesh is soft, and savours of mud. The third species was introduced into the British Fauna by Berkenhout. Turton says it occurs in the "clear streams of Wiltshire."

The fishes which Bloch distinguished by the name ANABLEPS (a term first used by Artedi, and signifying to raise the eyes, or to look up, being derived from ἀναβλέπω) were long united with the loaches, although they afford characters of a very distinctive kind. Their eyes, which are very salient, and placed under an arch formed on each side by the frontal bone, have the cornea and iris divided into two portions by transverse bands, in such a manner that they have two pupils, and appear double, although in reality there is only a single crystalline and vitreous humour, and one retina,—a peculiarity of which no other instance is to be found among vertebrate animals. The organs of generation, moreover, and the bladder of the male, have their excretory canal in the anterior border of the anal fin, which is thick, long, and clothed with scales; its extremity is perforated, and no doubt subserves the generative functions. The female is viviparous, and the young are not produced till they have attained a considerable size.

The body of these fishes is cylindrical, and covered with scales; there are five branchial rays, the head is flat, the muzzle truncated, the mouth cleft transversely at the end, and armed in both jaws with numerous small teeth. The inter-maxillaries are without a pedicle, and suspended under the nasal bones, which form the anterior edge of the muzzle. The pectorals are in a great measure scaly, and a small dorsal is placed over the tail, and further back than the anal. Their pharyngeal bones are large, and provided with numerous small globular teeth; their air-bladder is very large, and also their intestine; but the latter is without cæca. Only one species is known, which is an inhabitant of the rivers of Guiana. It is the *Anableps tetropthalmus*, Bl. 361. See Plate CCCIV. fig. 8.

GENUS PÆCILIA, Schn. Has the two jaws flattened horizontally, protractile, slightly cleft, furnished with a series of small and very fine teeth, the upper side of the head flattened, the opercula large, five branchial rays, the body not much elongated, the ventrals not far back, and the dorsal placed just above the anal. They are all small viviparous fishes, and inhabit the fresh waters of America. The only remaining genera included in the present family are *LEBIAS*, Cuv., *FUNDULUS*, Lacép., *MOLINESIA*, Lesueur, and *CYPRINODON*, Lacép., which comprehend but a limited number of species, most of them of small size, and presenting no peculiarities of particular interest.

FAMILY II.—ESOCIDÆ.

Corresponds to the undivided genus *Esox*, as established by Linnæus. It is characterised by the want of the adipose dorsal; by having the edge of the upper jaw formed by the inter-maxillary, or at least, when not wholly formed by that bone, the maxillary is without teeth, and concealed in the thickness of the lips. They are a very voracious tribe of fishes; their intestine is short and without cæca, and all are provided with a swimming bladder. With the exception of the *Microstoma*, all the kinds with which we are acquainted have the dorsal opposite the anal.

In the Cuvierian system this family is divided into many genera, of the principal of which we shall now proceed to give some account. Such fishes as belong to

GENUS *ESOX*, in its present restricted acceptance, have

¹ The genus *LEUCISCUS* contains also the dace, chub, and other well-known British species.

Malacop-
terygii
Abdomi-
nales.
Esocidæ.

small inter-maxillaries provided with minute pointed teeth in the middle of the upper jaw, of which they form the two thirds; but the maxillaries occupying the sides are without teeth. The vomer, the palatines, the tongue, the pharyngeals, and the arches of the branchiæ, are covered with teeth resembling those of a card; and, in addition to these, a series of long pointed teeth occupy the sides of the lower jaw. The snout is oblong and obtuse, broad and depressed; and there is only one dorsal opposite the anal. The stomach, which is large and plicate, is continuous with a slender doubly-folded intestine without cæca. The swimming bladder is very large. There is only one European species, viz. *Esox lucius*, Linn. (the common pike), Plate CCCIV. fig. 9. During the earliest stage of its life it is of a greenish hue, but in the second year it becomes gray with pale spots, the latter ultimately acquiring a yellowish colour. Its markings, however, are very variable, and instances have occurred of its being perfectly white. It is one of the largest of fresh-water fishes, and indeed, if the accounts which some writers give are not exaggerated, it occasionally attains a size not greatly inferior to the gigantic inhabitants of the ocean. Individuals are recorded as measuring from five to nine feet in length. They frequently weigh above thirty pounds in the lakes of the north of England; and Dr Grierson mentions one taken in Loch Ken, in Galloway, which weighed sixty-one pounds. Bloch indeed examined a portion of the skeleton of another which could not be less than eight feet in length. The most remarkable pike, however, of which we have any authentic account, is that caught at Kaiserslautern, near Manheim, in 1497, which was nearly nineteen feet in length, and weighed 350 pounds. The skeleton of this extraordinary specimen was for a long time preserved, and bore a brass ring with an inscription to the effect that the fish was put into a pond by the hands of the Emperor Frederick II., the 5th of October 1262. From this it is inferred that it was upwards of 235 years old. Pikes are proverbially voracious. There seems indeed to be no bounds to their gluttony, for they devour indiscriminately whatever edible substances they fall in with, and almost every animal they are able to subdue. "It is," says M. de Lacépède, "the shark of the fresh waters; it reigns there a devastating tyrant, like the shark in the midst of the ocean; insatiable in its appetites, it ravages with fearful rapidity the streams, the lakes, and the fish-ponds where it inhabits. Blindly ferocious, it does not spare its species, and even devours its own young; gluttonous without choice, it tears and swallows with a sort of fury, the remains even of putrified carcasses. This blood-thirsty animal is also one of those to which nature has accorded the longest duration of years; for ages it terrifies, agitates, pursues, destroys, and consumes the feeble inhabitants of the waters which it infests; and as if, in spite of its insatiable cruelty, it was meant that it should receive every advantage, it has not only been gifted with strength, with size, with numerous weapons, but it has also been adorned with elegance of form, symmetry of proportions, and variety and richness of colour."¹ A singular instance of its voracity is related by Johnston, who asserts that he saw one killed which contained in its belly another pike of large size, and the latter on being opened was found to have swallowed a water-rat!

The pike inhabits almost all the fresh waters of Europe, but seems to flourish most in the northern and middle countries. It likewise occurs in abundance in Asia and North America. Its flesh is well flavoured and easy of digestion, and is consequently much sought after as an

article of food, especially for convalescents, and others of weakly habit. It is most tender and nutritive in young individuals, but full-grown pikes are occasionally found, in which the flesh on the back and near the vertebral column acquires a greenish colour, which is held in high repute, and often purchased at a great price.

GENUS GALAXIAS, Cuv. Has the body without apparent scales, the mouth slightly cleft, pointed teeth of moderate size on the palatines and both jaws, the upper jaw having almost its entire edge formed by the inter-maxillary. There are also some strong hooked teeth on the tongue. The *Esox truttaeus*, Cuv., *Esox alepoditus*, Forst. exhibits the structure above described.

GENUS ALEPOCEPHALUS, Risso. The species of this genus bear a very close resemblance in their general form to those of the preceding group, but their head only is destitute of scales, the body being covered with scales of large size; their mouth is small, and the teeth small and crowded. The eye is very large, and the gills have eight rays. Only one species is known, and it inhabits the deepest parts of the Mediterranean. It is the *A. rostratus*, Risso, 2d ed. f. 27.

GENUS MICROSTOMA, Cuv. Have the snout very short, the lower jaw more advanced, and furnished, as well as the small inter-maxillaries, with very fine teeth; three broad and flat branchial rays; the eye large, the body elongated, and having the lateral line garnished with a series of strong scales. There is a single dorsal a little behind the position of the ventrals, and the intestines are similar to those of the pikes. The only species known (*Serpa microstoma*, Risso, p. 356) inhabits the Mediterranean.

GENUS STOMIAS, Cuv. Muzzle extremely short, the mouth cleft almost to the gills, the opercula reduced to small membranous leaflets, and the maxillaries fixed to the cheek; inter-maxillaries, palatines, and mandibles armed with small bent teeth, and the tongue with similar ones. Their body is elongated, their ventrals altogether behind, and their dorsal opposite their anal, on the hinder extremity of the body. We are acquainted with two species of these singular fishes, *Esox boa*, Risso, and *Stomias barbatus*, both from the Mediterranean.

The genera CHAULIODUS (of which the sole species, found near Gibraltar, is shown on Plate CCCIV. fig. 10), SALANX, and BELONE, comprehend a few species found chiefly in the Mediterranean. In the last-mentioned genus, the inter-maxillaries form the whole edge of the upper jaw, which is prolonged, as well as the inferior, into a long snout, and both provided with small teeth; there are no other teeth in the mouth, and those of the pharynx are *en paré*. Their body is long, and covered with indistinct scales, except a longitudinal carinated range on each side, near the inferior edge. The bones are very remarkable for their fine green colour. The intestines differ in their structure from those of the pikes. One species inhabits the European coasts, which is about two feet long, green above, and white beneath. It affords a good dish, in spite of the prejudice caused by the colour of its bones. It is the *Esox belone*, sea-pike, or *gar-fish*. Species nearly allied are to be found in all seas. Of these, one is said to reach eight feet in length, and its bite is reported to be dangerous.

GENUS SCOMBER-ESOX, Lacép. Has a snout of the same structure as in *Belone*, nearly the same appearance and arrangement of the scales, but the last rays of the dorsal and anal are detached in spurious fins, as in the mackerels. One of them occurs in the Mediterranean, viz.

Malacop-
terygii
Abdomi-
nales.
Esocidæ.

¹ Quoted in Griffith's edition of the *Règne Animal*. We cannot, however, agree with M. Lacépède in his admiration of the general appearance of the pike, for we think its long lank jaws and sunken eye give it rather a diabolical aspect.

Malacop-
terygii
Abdomi-
nales.
Esocidæ.

Esox saurus, Bl. Sch. pl. lxxviii. 2, and is also found along the British shores, where it is known under the name of *Egyptian herring*. It sometimes leaps so actively out of the water as to pass over a space of thirty or forty feet. Of the nearly allied genus *HEMI-RAMPHUS*, Cuv. several species are to be found in the warm latitudes of both hemispheres. Although their flesh is oily, it is of an agreeable taste.

We now come to a tribe of fishes which have attracted much attention, owing to the power they possess of leaping to a great height into the air, and even sustaining themselves in that element for a perceptible time. This faculty, which has caused them to be named *flying fishes*, they owe to the excessive development of their pectorals, a peculiarity which readily distinguishes them from all other abdominal fishes. Their head and body are clothed with scales, and a longitudinal series of carinated scales forms a salient line at the bottom of each flank, as in some of the genera last described. The head is flattened above and on the sides; the dorsal is placed above the anal, the eyes are large, the inter-maxillaries without pedicles, and themselves forming the edge of the upper jaw. The two jaws are furnished with small pointed teeth, and the pharyngeal bones with teeth *en paré*. Such as present these characters are to be referred to the

GENUS *EXOCETUS*, Linn., a name which signifies *lying out*, and which was given by the ancient Greeks to a fish that was reported to be in the habit of coming to repose on shore. They are further characterised by having ten branchial rays, a very large swimming bladder, and straight intestines without cæca; the upper lobe of the caudal fin is the shortest.

The *Exocetus volitans*, Bloch, 398 (see Plate CCCIV. fig. 11), is a well-known flying fish of the ocean (but not to be confounded, as it has sometimes been, with the *Trigla volitans*, or flying gurnard, already alluded to under the genus *DACTYLOPTERUS*). It is common in many of the warmer parts of the northern hemisphere, especially between Teneriffe and the line. It is also said to occur occasionally in the Mediterranean, and may be recognised by its large eyes, and the smallness of the ventral fins, which are placed in advance of the centre of the body. Its mouth is slightly tubular, its scales deciduous, and its size from six to twelve inches. A species more common in the Mediterranean is the *E. exiliens*, Bloch, 397, of which the ventrals are long, and placed behind the centre of the body. It attains to the length of fifteen inches. The young have black bands upon the fins.

¹ Some difference of opinion seems still to exist in regard to the mode of flight in these fishes. Mr Bennet supposes, that because they do not use their pectoral fins in the air precisely as birds use their wings, that their progression ought rather to be termed leaping than flying. "In fish," he observes, "the organ of motion for propelling them through the water is the tail, and the fins direct their course; in birds, on the contrary, the wings are the organs of motion, and the tail the rudder. The only use of the extended pectoral fins in the fish is for the purpose of supporting the animal in the air, like a parachute, after it has leaped from the water by some power which is possessed even by the whale. From the structure of the fin, I cannot consider it at all calculated for repeated percussions out of the water; while in that fluid, it continues its natural action uninjured; but it soon dries when brought into contact with the air, and the delicacy of the membrane between the rays would very readily become injured were the organ similarly exerted in that

medium. The greatest length of time that I have seen these *volatile* fish on the *fin*, has been thirty seconds by the watch.... Their usual height of flight is from two to three feet; but I have known them come on board at a height of fourteen feet; and they have been well ascertained to come into the channels of a line-of-battle ship, *i. e.* as high as twenty feet and upwards. But it must not be supposed that they have the power of elevating themselves in the air, after having left their native element: on watching them, I have often seen them fall much below the elevation at which they first rose from the water, but never in any one instance could I observe them raise themselves above that height. I therefore regard the elevation they take to depend on the power of the first spring or leap they make on leaving their native element."¹ Colonel Bory St Vincent, on the other hand, regards that opinion as erroneous which limits their aerial movements to a single sudden spring. "Je n'ai pas vu les exocets s'élever très-haut; mais je souvent observe qu'ils ne se replongeaient dans la mer qu'à une bonne portée de fusil au moins du point d'où ils étaient partis. Selon l'occasion, ils changent la direction de leur vol, et s'abaissent ou s'élèvent parallèlement aux flots agités; ils ont enfin la faculté de voler d'une manière bien plus parfaite qu'on ne la leur suppose généralement."² The double chase of this unfortunate species was indicated by Duquesne so far back as 1690. "Ce petits animaux," observes that voyager, "n'ont nul repos, ni dans l'eau, ni dans l'air; dans l'eau, à cause des bonites, dans l'air, à cause des oiseaux qui fondent sur eux avec plus de rapidité que le faucon ne fond sur la perdrix."³ Indeed, all voyagers, whether ancient or modern, have recorded the delight with which they witnessed these sudden emergencies; and Bosc in particular describes the flying fish as sometimes rising in hundreds, and even thousands, around his vessel, and darting over the waves in all directions, scouring away, as Coleridge has beautifully said in relation to another group of animals, "like a Tartar troop over the wilderness." We shall conclude this notice by observing that the flesh of flying fishes is savoury and delicate, and that they thus present another claim to the attention of the voyager.

At the end of the family of the *ESOCIDÆ* is to be placed a genus which differs but a little from them, except in having long intestines provided with two cæca, and which will probably be formed into a particular family.

GENUS *MORMYRUS*, Linn. Body compressed, oblong and sealy; tail slender at the base, and enlarged towards the fin; head covered with a thick naked skin, enveloping the opercula and the branchial rays, and leaving for their aperture only a vertical cleft, a circumstance which has caused some naturalists to deny the existence of opercula, although they are as complete as in any other fish, and to assign to them only two branchial rays, although there are five or six. The opening of the mouth is very small, almost as in those *Mammalia* named anteaters, and the maxillaries form its angles. The teeth, which are slender and notched at the end, cover the inter-maxillaries and the lower jaw; while on the tongue, and under the vomer, there is a band of small and crowded teeth. The stomach is in the form of a rounded sac, followed by two cæca, and a long slender intestine always enveloped in a profusion of fat. The bladder is long, large, and simple. Many of these fishes inhabit the Nile, and they are ranked among the best which that river produces. It is conjectured that it was one of them which the ancient Egyptians held in religious veneration, and which they named *oxyrhincus*.

Malacop-
terygii
Abdomi-
nales.
Esocidæ.

¹ *Wanderings in New South Wales*, &c. vol. ii. p. 31.

² *Voyage aux quatre îles d'Afrique*, t. i. p. 83.

³ *Voyage aux Indes Orientales*, t. i. p. 236.

Malacop-
terygii
Abdomi-
nales.
Siluridæ.

FAMILY III.—SILURIDÆ.

Is distinguished from all the others in the order by having no true scales, but only a naked skin, or large osseous plates. The inter-maxillaries, suspended under the ethmoid, form the edge of the upper jaw; and the maxillaries are reduced either to mere vestiges, or are lengthened into barbels. The intestinal canal is large, folded, and without cæca; the bladder large, and adhering to a peculiar osseous process; the dorsal and pectorals have almost always a strong articulated spine for the first ray, and there is very frequently an adipose fin behind, as in the Salmonidæ.

GENUS SILURUS. A numerous genus, known by its want of scales, the mouth cleft at the end of the snout, and, in the greater number of sub-genera, by the first ray of the pectoral being composed of a strong spine. This is articulated to the shoulder bone, in such a manner that the animal at pleasure can either draw it towards its body or erect it perpendicularly, in which case it becomes a dangerous weapon, and inflicts wounds which in some countries are considered venomous, doubtless because tetanus or lock-jaw sometimes ensues. The head of the *Siluri* is depressed; the maxillaries very small; and the covering of the branchiæ wants that piece which has been named by Cuvier the *sub-opercle*.

In some species (*Silurus*, Lacép. properly so called) there is only one small fin, with few rays on the anterior part of the back, but the anal is very long, and reaches nearly to the caudal. In others, more especially so named by Artedi and Gronovius, the small dorsal is without any apparent spine; the teeth on both jaws are like those of a wool card, and behind the inter-maxillary band of teeth there is a vomerian band. Of this kind of structure an example is found in *Silurus glanis*, L. which is the largest of European fresh-water fishes, and the only one of this extensive genus inhabiting the Continent. See Plate CCCIV. fig. 12. It is smooth, greenish black, spotted with black above, and yellowish-white beneath. The head is large, with six barbels. It sometimes attains the length of twelve or fifteen feet, and the weight of 300 or 400 pounds. As this creature is somewhat unwieldy in its motions, it does not pursue its prey, which consists of small fishes, but lies concealed among the mud, and seizes such unwary stragglers as happen to come within reach. It has occasionally been observed in the sea, but always near the mouths of rivers, and in such other situations as to leave no doubt that its appearance there is to be ascribed to accidental causes. The flesh is fat and sweet, and its lard has been employed in some places as a substitute for that of the hog. Sir Robert Sibbald, at the conclusion of his list of river fishes, adds, "*Silurus sive Glanis*;"¹ from which it has been inferred that this gigantic species may at one period have inhabited the Scottish rivers.²

A few fishes, found hitherto only in the Nile, differ from the *Siluri* in having their bodies compressed vertically, and by having a strong and denticulated spine to the dorsal. Their head is small and depressed, the nape suddenly raised, and the eyes placed very low—circumstances which bestow upon them a very singular appearance. They constitute the genus *SCHILBUS*. The *PIMELODI* of Lacépède are characterised by the body being covered only by a naked skin, without lateral armature. This definition, however, comprehends a great number of fishes, many of which present so many differences in appearance and structure, that it is necessary that they should be grouped in several

subordinate genera. The first of these, established by Cuvier, and which he names *BAGRUS*, has in each jaw a band of small crowded teeth, and behind those of the upper jaw a parallel band which belongs to the vomer. They admit of still further subdivision, from the number of their barbels and the form of their head. Among those having eight barbels, some have the head oblong and depressed; in others it is broad and short. Of such as are furnished with six barbels, the most remarkable have the muzzle depressed and broad, after the manner of the pike; while others have the head of an oval form, and its shagreened bones forming a kind of helmet. The *PIMELODI*, however, properly so called, have no band of teeth on the vomer, parallel to that of the upper jaw, but there are often some on the palatines. In the number of their barbels, and in the form of their heads, these fishes present still more numerous varieties than the *Bagri*. Thus, among such as have only a single band of teeth, some are observed to have the head helmeted, and a distinct osseous plate or buckler between the helmet and the spine of the dorsal. Such is *Sil. clarias*, Bl. xxxv. 1, 2. In others the buckler is united to the helmet, and forms only a single body with it, the helmet thus extending from the muzzle as far as the dorsal. In some instances the head is oval, clothed only by the skin, through which the bones do not appear; in this group the species have either six or eight barbels. In those called *cat-fish*, the head is naked but very broad, and their barbels also vary, according to the species, from six to eight. We ought probably to place here the *Mathe-megh* of the Cree Indians (*Silurus felis*, Gm.?), described by Dr Richardson as found sparingly in the lakes that flow into the Saskatchewan, and more abundantly in the lakes and rivers to the southward. It is much prized as a rich food.³ Numerous other modifications of structure are to be found in this extensive genus, of which the greater proportion of the constituent species have but recently become known to naturalists. Several have the muzzle elongated, and these lead to a group of still more remarkable conformation, viz.

GENUS *SYNODONTIS*, Cuv. In which the muzzle is narrow, and the lower jaw supports a packet of teeth much flattened laterally, terminating in hooks, and each suspended by a flexible pedicle; a kind of dentition of which no other example is known. The rough helmet, formed by the cranium of these fishes, is continuous, without any interruption, with an osseous plate, which extends to the base of the spine of the first dorsal; and that spine is very strong, as is likewise the case with those of the pectorals. The lower barbels, and sometimes also the maxillaries, have lateral barbels. The species are found in the Nile and Senegal, and are known to the inhabitants of Lower Egypt by the general name of *Schal*, while in the upper regions of the same country they are termed *Gurgur*. Their flesh is not accounted of any value. The *AGENIOSI* of Lacép. possess all the characters of the *Pimelodi*, but they are without the barbels properly so called. *Silurus inermis* (Bl. 363) affords an example.

GENUS *DORAS*, Lacép. Contains such *Siluri* as have a second adipose dorsal, and the lateral line defended by a row of osseous pieces, each relieved by a spine or projecting keel. Their dorsal and pectoral spines are very strong, and powerfully dentated. Their helmet is rough, and is continued as far as the dorsal, as in *Synodontis*, and the humeral bone forms a point behind.

GENUS *HETEROBRANCHIUS*, Geoff. Has the head provided with a rough, flat buckler, wider than in any other of the *Siluri*, because the frontals and parietals produce

Malacop-
terygii
Abdomi-
nales.
Siluridæ.

¹ *Scotia Illustrata*, p. 25.

² *Fleming's British Animals*, p. 198.

³ *Appendix to Captain Franklin's first Voyage to the Polar Sea*, p. 724.

Malacop-
terygii
Abdomi-
nales.
Siluridae.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidae.

lateral plates which cover the orbit and the temple. The opercle is still smaller in proportion than in the foregoing genera, and the peculiarity observed by Geoffroy distinguishes them from all other fishes, viz. that besides the ordinary branchiæ, they have ramified appendages like trees adhering to the superior branch of the third and fourth branchial arch, and which appear to be a kind of supernumerary branchiæ. All the species pertaining to this genus are found in the Nile, Senegal, and a few of the Asiatic rivers. Their flesh is either of indifferent quality, or altogether unfit for food. This is not the case, however, with the *Sharnuth* or *Black-fish* (*Silurus anguillaris*, Hasselg.), which is common in Egypt and Syria, and constitutes in the latter country a valuable article for the table.

GENUS *Plotosus*, Lacép. Is characterised by a second radiated dorsal, of great length, as well as the anal; and both uniting at the caudal, form a point, as in the eel. Their lips are fleshy and pendent; the throat armed anteriorly with conical teeth, behind which there are others of a globular form, which at the upper jaw pertain to the vomer. The head, as well as the rest of the body, is enveloped in a thick skin, and the branchial membrane has nine or ten rays. All the known species are from the East Indies. They have eight barbels, and, behind the anus, the fleshy and conical tubercle common to all the *Siluri*; and there is, besides, a fleshy ramified appendage, the functions of which, though unknown, are probably remarkable. Some have the dorsal and pectoral spines dentated, and of considerable size. Such is *Platystacus anguillaris*, Bl. 373, while others have them concealed beneath the skin. The latter is the case with *Plotosus casius*, Buchan. xv. 44. Certain fishes referred by Linnæus to the genus *Callichthys*, and pertaining to that named *CATAPHRACTUS* by Lacép., have their bodies almost entirely cuirassed, so to speak, on its sides, by four rows of scaly pieces; and there is likewise on the head a compartment of these pieces. The extremity of the muzzle, however, is naked, as well as the under side of the body. The second dorsal has but a single ray in its anterior edge; the pectoral spine is strong, but the dorsal is slender or short. The mouth is but little cleft, and the teeth nearly imperceptible; the barbels, four in number; the eyes small, and placed on the sides of the head. These fishes can crawl for some time on dry land like the eel. In some the pectoral spine is merely rough, in others it is dentate, as in the majority of the *Siluri*.

GENUS *MALAPTERURUS*, Lacép. Distinguished from all the true *Siluri* by having no rayed fin upon the back, but only a small adipose one on the tail, and by the want of a spine to the pectorals, of which the rays are entirely soft. But one species is known with six barbels, the head not so thick as the body, which is inflated in front. It is the famous electric *Silurus* (*Silurus electricus*, Linn.) of the Nile and of Senegal; the *Raash* or *Thunder* of the Arabs, which gives electrical shocks like the *Torpedo* and *Gymnotus*. It appears that the seat of this faculty is a particular tissue situate between the skin and muscles, and which presents the appearance of an adipose cellular substance, abundantly supplied with nerves.

GENUS *ASPREDO*, Linn. *Platystacus*, Bl. Presents very peculiar characters in the flattening of the head, and the enlargement of the anterior part of the trunk, which principally results from the size of the humeral bones; in the proportional length of the tail; in the small eyes placed in the superior face; and in the inter-maxillaries being inclined under the ethmoid, directed backwards, and bearing teeth only on the hinder edge. In addition to these

peculiarities, they are the only osseous fishes known which have no mobility in the operculum, because the pieces which ought to compose it are soldered to the tympanum and pre-opercle. Only a few species have come under the cognizance of naturalists, such as the *Silurus Aspredo*, Linn.; *Plat. cotylephorus*, Bl. 372; *Silurus hexadactylus*, Lacép. They have six or eight barbels, and it is remarkable, that when there are eight, one pair is attached to the base of the maxillary barbels; the four of the lower jaw are in pairs, one behind the other. Globules are seen on some of these fishes, which appear to be their eggs, adhering to the thorax by means of pedicles.

GENUS *LORICARIA*, Linn. Is so named on account of the rigid angular plates which completely cover the body and head, as with a coat of mail, and is further distinguished from such kinds as possess a somewhat similar defensive armour by having the mouth pierced under the muzzle. In position and mode of conformation, this mouth is most analogous to that of *Synodontis*; the inter-maxillaries are small and suspended under the muzzle, and the mandibular bones, which are transverse and separate, bear long flexible teeth, terminating in a hook. A broad, circular, and membranous veil surrounds the aperture; and the pharyngeal bones are garnished with numerous teeth *en paré*. The true opercula are immoveable, as in *Aspredo*, but two small, moveable, external plates seem to perform their office. The branchial membrane has four rays; and the first rays of the dorsal and pectorals, and even of the ventrals, are strong spines. There is neither cæca nor air-bladder. The species may now be arranged in two sub-genera, viz. *HYPOSTOMA*, Lacép., which has a second small dorsal, provided with a single ray, as in *Callichthys*. Their labial veil is simply papillose, and bears a small barbel on each side. They have no plates under the belly, and the intestines, which are spirally convoluted, are as slender as a pack-thread, and twelve or fifteen times longer than the body. They are caught in the rivers of South America. *Loricaria plecostomus*, Linn., Bl. 376, and *Hyp. etentaculatum*, Spix, iv. are examples of this sub-genus. *LORICARIA*, properly so called, has but a single dorsal in front: their labial veil is garnished on its edges with many barbels, and sometimes covered with villousities; the belly is defended by plates, and the intestines are of moderate thickness. To this group belong *L. cataphracta*, Linn.; *L. rostrata*, Spix; *Rinelepis aspera* and *Acanthicus hystrix*, Id.

FAMILY IV.—SALMONIDÆ.¹

The fourth family of the *Malacopterygii* of Cuvier is composed almost entirely of the Linnæan genus *Salmo*, and has in consequence received from modern Ichthyologists the title of *SALMONIDÆ*. It will remain, however, to future observation to determine whether the family shall take its title from the salmon, as typical of the form, or from some other group, leaving to the above-mentioned fishes the value of a sub-family only. As it is, the circumstance of the present Salmonidæ possessing a small adipose fin, placed between the dorsal fin and the tail, has been used in a light purely artificial, and too much consequence has been attached to it. Mons. Agassiz is of opinion that the Clupeæ should be added to them, as differing only in the want of this fin; while all the Salmones of Cuvier do not possess a true adipose fin,—that part being composed of rays in the genera *Serrasalumus* and *Myletes*.

The family, as it now stands, may be characterised by

¹ As an illustration of the *SALMONIDÆ*, we here figure (from Mr Griffith's *Animal Kingdom*) *Salmo Canadensis*, a North American species, beautifully spotted with blood red on a white circle. See Plate CCCV. fig. 1.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidae.

a lengthened form, the body covered with scales of no great size, and furnished with two dorsal fins. The first dorsal fin is composed of soft rays; the second, generally of a fatty substance, resembling a fold of the skin, is usually of small size. The tail is remarkably powerful, acting as an elastic lever, and, as usual, constitutes the principal organ of locomotion. The margins of the jaws are formed by the maxillary and inter-maxillary bones, and, with the vomer and palate bones, are commonly thickly studded with teeth, strong, conical, and bending backwards. The maxillary and inter-maxillary bones constitute a single continuous arch, as in the higher animals. The pyloric portion of the stomach is furnished with numerous appendices connected with a pancreas. The swimming bladder is large and oblong, and opens into the gullet near the extremity. They are voracious, feed on insects, the less Crustacea, and small fishes. Many of the species are migratory, and approach the mouths of rivers, or ascend their streams for the purpose of spawning. In the breeding season they are marked by some appendage peculiar to the time, or by a change to colouring of more brilliant tints. They reach a large size. The flesh is well flavoured and wholesome.

In the modern arrangement it was found necessary to separate the SALMONIDÆ into groups; and in the present sketch we shall follow those proposed or adopted by Baron Cuvier in the last edition of the *Règne Animal*,—having deeply to regret that his decease should have prevented his great ichthyological work from advancing to a branch of the subject which still stands in need of revision, and which would undoubtedly have derived the most signal advantage from the exercise of his critical skill.

GENUS SALMO, Cuv. Edges of the upper jaws formed by the maxillary and inter-maxillary bones, which, with the palatine bones, vomer, and tongue, are armed with strong conical recurved teeth; rays of the gill-covers from ten to twelve; tail very powerful; posterior dorsal fin adipose; ventral fins placed opposite the anterior dorsal, anal opposite the posterior; vertebræ from fifty-six to sixty. The male fish has the nose elongated and the under jaw hooked during the breeding season. The silvery colours change to gray and red. The species inhabit the sea and fresh waters. Some migrate at the breeding season; all spawn in shallow streams, and both sexes assist in forming the spawning bed. They inhabit Europe, Asia, and America.

The fishes which constitute this genus are of great importance, and are by far the most esteemed and valuable of all those which inhabit the fresh waters. The value of the fisheries, with the number of men engaged in them, is very great, and the expense of the materials which are consumed in the capture of one or two species is immense. In Britain they are mostly consumed in the great towns, either in a recent or prepared condition. In the north of Europe and America numbers are salted or otherwise cured for exportation. At the commencement of the genus is generally placed

Salmo salar, or *common salmon*, a species which likewise occupies the foremost place in the estimation of both sportsman and epicure. The salmon is a fish of great elegance, combining a form fitted alike for strength and swiftness; and its depth and thickness, while in good condition, are so proportioned to its length as at once to convey the idea of a pleasing symmetry. The body above is of a rich bluish or greenish gray, changing below to silvery, sprinkled above the lateral line with rather large sub-cruciform black spots, a few of which at the shoulders generally extend below the line. The characters which distinguish it from its British congeners are the different form of the opercular bones, which show a rounded outline to the posterior edge of the gill-covers, the longest diameter of which to the nose would

be in a line through the eye, while in all the other British migratory species the same line would pass much below the eye. The black inner surface of the pectoral fin is nearly a constant mark. The tail is forked in the young state, but fills up to a nearly square outline in the adult, in which the width between the extremities is proportionally wider than in *S. eriox*, the only migratory species which attains a weight at all approaching that of the salmon. The outline of the scales also presents distinguishable differences.

The common salmon inhabits the seas around Great Britain, and extends to the north of Europe and to Asia; but it is not properly ascertained that those found in North America are identical. Its true abode may be called the sea; for as soon as it has entered the rivers it begins to deteriorate in condition, the scales lose their brilliant silvery lustre, and the flesh becomes soft and pale. It is drawn to the fresh waters by that natural instinct so wisely implanted for the purpose of its reproduction, an instinct which enables it to stem the current of the most rapid rivers, to ascend precipitous falls, and to pass through weirs and obstacles of human intervention, which no other power could overcome. This desire of looking for a suitable place in which to deposit their ova is their sole reason for thus seeking the "rivers of water," the torment of sea insects, or other causes which have been assigned, having no influence. This may be at once understood from the fact of the barren fish continuing their usual haunts along the coast, while a great many do not for a year at all enter the fresh waters. It is during this run to the proper spawning beds that the greatest numbers are captured, either by weirs, cruives, nets, or the rod; and it is then also that the sporting angler alone can ply his vocation, almost all attempts to angle the salmon in salt water having yet proved unsuccessful. Many fish far advanced with spawn are by these means destroyed; for unfortunately the most advanced are the most voracious, and a needy fisherman looks more to his present gain than to an expected produce of another year. It would be well and wise if the net fisheries of this valuable species were more confined to the tide-ways, where, in some estuaries, they are extensively carried on (as well as in the rivers) by means of stake-nets. These are so constructed as to intercept the fish entering the rivers, all in a high state of condition, and are sometimes wrought to such an extent as to employ several miles of netting.

Salmon generally delay entering the rivers in great numbers until the streams become somewhat swollen by rains, although in the larger rivers there may be said to be a limited daily run. When the flood has fairly mingled with, and to a certain extent has saturated, the estuaries, the rush of fish is often very great, especially if there has been a continued tract of dry weather. In the latter case they collect at the mouths of rivers, and are seen and often taken in vast numbers; but they do not then attempt an ascent, deterred perhaps by the clearness of the stream, or by some instinctive feeling that the water would yet be deficient to carry them through. As the *fresh* approaches, however, an increased activity may be perceived; and, as far as we can judge, the change is probably indicated by the nostrils receiving a sense of the mixture of the waters, by means of the large ramification of nerves with which they are supplied; and to this same sense may perhaps be attributed the singular fact of the greater proportion of salmon returning to the very streams in which they were spawned. The fish, on entering the river, rush forward as long as the flood continues, seldom resting in their course during the time that the water continues discoloured. From ten to twenty-five miles daily is the rate, as far as can be ascertained, at which they are supposed to travel.

In their more lengthened courses, where the rivers are deeper and the interruptions less frequent, the rate at

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidae.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidae.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidae.

which salmon travel is probably much more rapid. We know indeed little as yet regarding the identity of species between our own and those of foreign regions, but if, as some suppose, our salmon attains to the lofty Cordilleras of South America, by means of the mighty Maragnon, then it must run a course of about 800 leagues. Bearing in mind, however, that the salmon is a truly northern fish (that they occur in *some* abundance in the arctic regions, may be inferred from the fact, that Commander Ross, during his recent voyage, took *three thousand three hundred and seventy-eight* at one haul, in the month of July; and that his uncle Sir John obtained a *ton weight* of salmon from an Esquimaux, in exchange for one or two knives!), and also remembering those laws of distribution which regulate, and, with a few exceptions, circumscribe, the localities of living creatures, we think it more than likely that the South American salmon belong to another species. We know, however, that our common kind (*Salmo salar*) makes its way by the Elbe into Bohemia, and through the Loire as far as the environs of Puy, in the ancient Velay. We also know that it works its way up the Rhine, and visits a portion of the rivers of Switzerland, although the irresistible torrent of the Falls of Schaffhausen prevents its ingress to any part of the basin of the great Lake of Constance. But we feel less assured of its occurrence in the Persian Gulf, or of the identity of the species found in the Caspian Sea. Neither can we credit that it advances unrepelled by the gloomy terrors of a subterranean journey, and that salmon from the Gulf, adorned by the fanciful Persians with rings of gold and silver, have been found in the Caspian. The non-existence of the supposed communication is of itself a pretty sufficient barrier, even did no other exist in the laws of nature, and were light and atmospheric air dispensable.

In our lower and clearer waters, however, they travel at a much slower rate than that above alluded to,—resting for some time in the pools by the way, and now and then taking a regular *lie* in some chosen spot, which they will return to daily as long as the river continues unfitted for their progress. Upon the least accession, however, to the water, either directly or from some swollen tributary, they are again upon the alert; and it is often felt by them several hours before the quickest or most experienced human eye can perceive a rise upon the river. Having ascended to a considerable height, they remain more stationary, and proceed more slowly with the subsequent floods, till the spawn increases in size. This increase, if not influenced by, is at least so connected with, the commencement of the colder weather, as then to proceed at a more rapid rate. As the spawn advances, the symmetry of the form is disfigured; the female becomes disproportionately large, the colours lose the brightness of their silvery tints, and become dull and gray. The male becomes thin upon the back, the nose elongates, and the under jaw turns up in a large and strong hook, which enters a hollow in the nose before the inter-maxillary bones. The colours and markings become brown and red, those on the head and gill-covers being particularly brilliant, and disposed in lines almost like the marking of a *Sparus*.¹ In this full breeding dress the male and female seek some ford or shallow stream, and commence to excavate a trench or furrow (chiefly by the exertions of the female). In this the spawn is deposited, and impregnated at the same time, and finally cov-

ered with gravel by the exertions of the fish. The furrow is generally from six to nine inches in depth; and when the spawn has appeared to be covered beyond that depth, this has occurred from some other circumstances,—such as the stream or floods having carried downward additional masses of gravel, &c. After this great effort has been accomplished, both sexes are reduced to a state of remarkable emaciation. The elongated nose, and hooked jaw, and brilliant colours, are almost immediately lost; the old scales are cast, and the fish retire to some pool to regain their strength and complete their new clothing. They finally redescend to the sea by easy stages, where their former condition and silvery lustre are regained, their strength invigorated, and all their functions so repaired as to enable them ere long to renew their visit to the flowing streams, again to multiply their race.

The ova continue covered by the gravel during the winter, and begin to vivify from about the end of March to the commencement of April. The fry remove from under the gravel when nearly an inch in length, with the ovum still attached; and at this period, if the spawning bed or furrow be turned up, it will appear in motion. When disengaged from the ova, the fish increase in size most rapidly, and about the end of April and during May commence and perform their first migration or journey to the sea. At this time they are from four to six inches in length, of a greenish gray above, silvery below, the scales extremely delicate and very deciduous. From the time they reach the sea, for two months or ten weeks, we lose sight of them, and can only infer their growth from the fact, that after the lapse of that period we find them again ascending the rivers with a weight of from two and a half to four pounds. They are then known under the name of *gilse* or *grilse*; and their size, as they ascend from the sea, increases with the advance of the season. The *gilse* which thus ascend spawn during the ensuing winter, and are then entitled to the name of *salmon*. Descending in a weak state (as before mentioned), they return again in the summer of the following year, as fish of from ten to fifteen pounds weight, according to special circumstances. A third year would still increase their weight, as would several ensuing seasons, till the attainment of an enormous size. Pennant, for example, mentions a salmon which weighed seventy-four pounds; and although we now regard with something of wonder a fish which weighs even the half of that amount, yet there is no doubt that not many years ago salmon of forty pounds were much more frequent than in these degenerate days.² The absence of salmon of the largest class from many of the Scotch rivers, where they formerly abounded, is in fact owing to the injudicious perfection of our fisheries, which occasions the constant capture of the species in the state of *gilse*, or other early condition; and the chances are by consequence greatly against any individual escaping the various dangers by which it is environed, for such a succession of years as is likely to admit of its attaining to its full dimensions. The destruction by poachers in the higher parts of the rivers, of the large enfeebled *kelts*, or fish which have completed their spawning operations, is also extremely prejudicial; for these individuals (almost utterly useless as food at the time alluded to) would, if allowed to descend to the salubrious sea, ere long revisit their native streams, greatly increased in size, and full of health and vigour.³

¹ In this state it has received from Cuvier the erroneous name of *S. hamatus*, as if it were a distinct species. See *Règne Animal*, t. ii. p. 303.

² We observe that a salmon above fifty pounds weight was recently taken at the mouth of the Leven in Dumbartonshire. The general capture this season (1835) has been very great in Scotland. Nearly 800 were taken at one haul in a bay of the island of Islay; and our calculation, from accurate data, is, that for some time past about a *hundred thousand salmon* (including *grilse*) have been shipped in Scotland *weekly* from our eastern ports alone. A friend of our own lately saw a salmon of sixty-one pounds weight on a fishmonger's stall in London.

³ The reader will consult with advantage the *Parliamentary Reports* of evidence taken by a Committee of the House of Commons,

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidae.

Salmo eriox, or *bull trout*, is another British species which attains a large size, and does not seem as yet clearly described as inhabiting any of the other European waters.¹ It reaches a weight of twenty-five pounds. It is thicker in proportion to its length than the salmon; the fins are much more muscular; the tail particularly so, and perfectly square at the end in all the stages of growth, while the distance between the two extremes of the web is smaller proportionally than in any of the other species. The head is larger in proportion than that of the salmon of a similar weight, and the opercular covering is more lengthened. The toothing is very strong. The general colours are, above greenish gray, the lower parts silvery white; the body above the lateral line being thickly covered with large cruciform black spots. In the breeding dress they assume a much blacker tint than the salmon, and want much of the red markings. All the under parts, jaws, and cheeks, become blotched with deep blackish gray. The flesh is of a yellowish tint, and is coarse, except in the young state; it has the least flavour, and is consequently less esteemed in the market than any of the other species. The hook of the under jaw of the male does not become so elongated as in the salmon. The old fish commence to enter the rivers about the end of July, and appear to deposit their spawn and return to the sea about a month earlier than the salmon. The young fish, of from two to three pounds weight, and in this state known as *whitlings*, enter the rivers about the beginning of June. In all its states it is a very powerful fish, and feeds voraciously and indiscriminately. When hooked it springs repeatedly from the water, and runs (to use an angler's expression) with extraordinary vigour to free itself. The river Tweed and its tributaries are among the principal localities for this fish. It occurs also, though more sparingly, in some of the rivers of the Solway, but appears to be rare on the west and north coasts of Scotland.²

Salmo trutta and *albus*.—These fish have been by most modern Ichthyologists described as distinct. The characters of each, however, are extremely difficult to determine; and it is most probable that they will both be found to merge into one species, entitled to the name of *Salmo trutta*. Both fish are very abundant, and are taken in great quantities in the Solway and its tributaries, and along the greater part of the west and north coasts of Scotland. In the first-named locality, they bear the name of *sea trout*, *herling*, and *whitling*; in the two latter, of *white trout* and *finnock*; and being transported to the markets of our metropolis, they receive the additional name of *salmon trout*. Thus we may easily conceive the immense confusion that may and has arisen from the use or abuse of provincial names. Along the south-east coast of Scotland they appear less abundant; but this may arise from the larger mesh employed in the nettings. The Tay and the Forth supply the Edinburgh market. In its largest state, or as known under the specific title of *trutta*, it enters the rivers from two and a half to six pounds weight in the end of May. It is of an elegant form, and possesses all the symmetry of the salmon. The head is small, the back remarkably broad when viewed from above; the tail slightly forked, and wide at the extremity of the web; the colour above greenish, inclining to bluish-gray, lower parts of the clearest silver;

body above the line spotted, as in *S. eriox*, with large, deep-black spots, but generally much fewer in number. The flesh is pink, richly flavoured, and much esteemed for the table. It ranks next to that of the salmon, and by many is esteemed more delicate than even that prized species. The *S. albus*, or smaller and younger state in which it is found, is very nearly of the same proportion, form, and colours. They approach the mouths of the rivers in the end of July and commencement of August, in immense profusion, and immediately enter the fresh waters, where an angler may take almost any quantity without the exercise of great skill. In the north they form a perquisite to the taxmen or kayners of the salmon fisheries,—above a thousand being sometimes taken at a sweep of the net. In the Solway they are taken in equal abundance in houses of the stake-net, covered for the purpose with net of a small mesh, and are then carried to the various country markets, and during the height of the run to the villages, in cart-loads, for sale. The flesh of this smaller fish (whether species or variety, as the case may be) is also pink, and delicately flavoured. Its food is likewise the same as that of the larger kind; in the sea small Crustacea (*Talitrus locusta* being a favourite and common food),—in fresh water aquatic insects, worms, minnows, or other small fish. They appear also to spawn rather earlier than the salmon, and after the same manner. The colours of both sorts during the breeding season are deep-grayish black, slightly tinted with brown in the males; and at this time they offer a most marked contrast (being black and lean) to the symmetrical form and brilliant silvery tints of their perfect condition.

The preceding species (*S. salar*, *eriox*, *trutta*, and *albus*)—whether three or four in number, is still, as we have said, a dubious point—appear to be the only migratory salmon yet known to inhabit the waters of Great Britain. On the Continent of Europe, however, we have the

Salmo hucho, said to be peculiar to the waters of the Danube, but most probably migratory to the Black Sea, and certainly not a native of the British waters, though inserted in many of our lists. It is a fish of extraordinary power, attaining to the weight of sixty pounds; and is of more lengthened proportions than the common salmon. The flesh pale coloured, and rather coarse. The young have large transverse bands upon the back and sides; with age these break up into spots, and gradually disappear, till the ground colour becomes uniform, and is only broken by the ordinarily black or violet spotting. In America, again, we have in this division the

Salmo Hearnii, or *Copper-mine River salmon*. Above olive-green, pale on the sides, and shading into bluish white, marked with longitudinal rows of flesh-red spots, largest on the sides, where they are about the size of a pea. The scales, like those of the other salmon of America, are much smaller than those of the European species, and in this fish they possess peculiar lustre. The teeth are weak and few, their size inferior to those of the common salmon. Their flesh is red. This fish is abundant during July and August, below the falls of the Copper-mine River.

The migratory salmon are distinguished from those which inhabit only the fresh waters by the clear grayish blue of the upper half of the body, and the brilliant silvery lustre of the belly and lower parts. Among those

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidae.

appointed to investigate the subject of the salmon fisheries. We beg also to refer to Dr Knox's Observations, published in the 12th volume of the *Transactions of the Royal Society of Edinburgh*.

¹ The young is the *whitling* of the Tweed, the *Berwick trout* of the London markets; but the *whitling* of all our Scottish rivers is not necessarily the young of *S. eriox*, in as far as provincial names are sometimes variously applied. In regard to the more scientific synonyms of this species, we know not what degree of relationship its adult state may bear to the *Traite de Mer* of the French,—*Salmo Schieffermulleri*, Bloch, 103.

² We have no doubt that the *Norway salmon* of the Sutherlandshire fisheries is identical with the above-described species,—that is, with the full-grown *Salmo eriox*.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nide.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nide.

which in common language receive the appellation of *trouts*, the colouring is more varied and of brighter tints, in which yellow and orange predominate, changing to various shades according to locality. The best and most familiar example is

Salmo fario, or *common trout*. This lovely fish is most extensively distributed over the whole of Northern Europe, being found in every burn and tarn, in every lake and river. It may be also said to be one of the most pleasing in its appearance; and, when newly taken in "golden glory" from some translucent stream, is exquisitely beautiful. The variation of the tints of the ground colour is infinite; yellow, however, is the most predominant, varying to the most brilliant orange; while at other times the ground colour of the body runs from a dark-greenish black to violet, in most instances numerously spotted with black and red. Sometimes, however, the black is alone present in the form of large round spots, placed in a pale circle, but in all cases beautifully relieved, and breaking up the uniformity of the other colours. In a few instances the spots have been observed to be wanting altogether. One cause of the variation in the trout, is the difference of food; and, according to every information we possess, those which feed on fresh-water shells, *Gammari* (screws, or fresh-water shrimps, as they are sometimes called), are of the most brilliant tint, and also of the finest flavour, with a decided pinkness in their flesh. Those feeding on the ordinary water insects are next in brilliancy and flavour, while such as live chiefly upon aquatic vegetables are dull in colour, and of soft consistence. This is further confirmed by the trout in *stews* being always finished, or *fed off* as it is called, on the foresaid *Gammari*, collected often from a distance. It is only in this way also that we can account for the variation in the appearance and flavour of trout found in two adjoining bays of the same lake. The individuals, in fact, do not appear to stray to any distance, but seem to be satisfied with whatever food is found within a limited district, and which of course will be in many instances of a peculiar and local kind. It is also true, that the colours of trout accommodate themselves to the tint of the water, and to the prevailing *tone* of the bottom, whether of rock or gravel, or of softer substance; and so constantly is this the case, that an experienced and observant angler has little difficulty in accurately predicating the general aspect of the fish of any lake or river. The presence of moss, so frequent in alpine districts, has invariably the effect of deepening the tints, particularly the shades of green and yellow.

In form this fish, when in perfect condition, may be said to be nearly symmetrical; the head only being sometimes rather large in proportion to the body, when considered in relation to what we regard as the *beau ideal*. The fins are of moderate strength, those of the body assuming a variation of form, from a rounded to a lengthened extremity. The tail is almost always forked; the fins are always coloured, that is, never of the transparent whiteness observable in the migratory species; and their tints are generally of a paler shade than those of the corresponding parts of the body. The anal fin is often bordered on its lower surface with white. The scaling is proportionally less than in the migratory kinds. The toothing is in general strong, and very prominent on both the tongue and vomer.

The average growth of the common trout, taking the species generally, may be stated at about a pound, and certainly not more than a pound and a half. In almost all

rivers, fish weighing beyond this may certainly be found; but they are comparatively uncommon. Individuals from two to six pounds weight are occasionally taken, even in what may be termed a "wild state." In ponds or stews, again, they reach a much greater size, but cannot be said to be in the natural condition of unenclosed fish. The Thames trout seem to reach most frequently the largest size, being short compared to their length, but of great thickness and well flavoured. Two were lately taken, the one of eleven, the other of fifteen pounds weight. The lakes in the north of England produce trout of very fine quality, and which are often passed off for char. Loch Leven, too (of which the barren isle and now dismantled castle are famous in history as the prison-place of the beautiful Queen Mary), has long been celebrated for its breed of trout. These, however, have fallen off of late considerably in their general flavour and condition, owing, it is said, to the partial drainage of the loch having destroyed their best feeding ground, by exposing the beds of fresh-water shells, which formed the greater portion of their food. Farther north (as in Sutherlandshire) the immense multitude of lochs produce a corresponding abundance and variety of trout. Of these, however, only a few are of superior quality; but these few may assuredly vie with the trout of any country in the world.¹ Another large species, occurring in the British waters, and not yet distinctly known elsewhere, is the

Salmo ferox, Jardine. This species reaches a weight of twenty-eight pounds, and is of very great power compared with its size. The characters which distinguish this fish from *S. fario* are the great size which it attains in a natural state, the large proportional size of the head, the square extremity of the tail in all the stages of its growth, the relative position of the fins, and the number of rays in the dorsal, which vary from 2—11 to 4—11. The external skin or covering of the scales is also extremely tough; and there is a difference in the form of the scales of the lateral line. In colour the upper parts are generally of a deep purplish brown, shading into purplish gray, and finally, on the lower parts, to greenish or grayish yellow, more or less tinted with orange. The spotting is large and not numerous, and consists of black spots placed in a pale circle, and of large pink spots with a similar light area. These extend over the gill-covers, upper fins, and often over the tail itself. A variety occurs in Loch Loyal, in Sutherland, above purplish brown, beneath blackish gray, the whole body spotted over with dark sepia-coloured spots, of a smaller size on the lower portions. *Salmo ferox* appears to be entirely confined to the lakes, seldom ascending or descending rivers, or wandering in and out of them, and never migrating to the sea. When spawning, it ascends for a short way up the rivers or streams which run into the lakes, but never, as far as yet known, descends those which run out of them. It inhabits, among the English lakes, Ulswater; but does not there reach a size above ten or eleven pounds. In Ireland, as far as we can yet learn (specimens having not yet reached us on this side of the water), it is found in Loch Neagh and some other large lakes; and in Scotland we have taken it in Loch Awe, Loch Laggan, the upper end of Loch Shin, and Lochs Loyal and Assynt. It is a fish of remarkable ferocity, and as great an enemy to its smaller companions as the pike. It may be taken by night lines, or by strong trolling tackle, baited with a small trout, and will return a second and third time to the bait, even after it has been dragged for forty or fifty yards.²

¹ We may here note the existence of a strongly marked and peculiar variety, called the *gillaroo trout* of Galway. It is remarkable for feeding on shell-fish, in consequence of which (as is supposed) the coats of the stomach acquire a great degree of thickness,—from which peculiarity it is sometimes called the *gizzard trout*.

² For a detailed account of the mode of fishing for this and the other species, see our article *ANGLING*, in the third volume of the present work.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidæ.

S. salmulus, or *parr*. An abundant species in all the clear running streams in England and Wales, and the south of Scotland; but in the last-named country it begins to decrease, so as to become comparatively rare, towards the north. It frequents the clearest streams, delighting in the shallower fords having a fine gravelly bottom, and hanging there in shoals, in constant activity apparently both day and night. It is found during the whole year in the rivers; but its breeding has not yet been discovered, though the fish are found in such a state as to shed their spawn when handled, close to the verge of the tide-way. It is a remarkably beautiful little fish when newly taken from the water, above of a greenish gray, beneath white inclining to yellowish, the sides marked with dull bluish patches of an oval form, and the body above the lateral line sparingly spotted with brownish-black and red. On the gill-covers there are two black spots, one of which is often indistinct. This fish has been always confounded, and still is so, with other species. Many maintain it to be the young of the salmon, while others insist that it bears that relationship to the common trout. The presence of the dark finger-like markings upon their sides has naturally assisted in this confusion. These marks, however, are distinguished by being always narrower in their form than in the trout or young salmon.¹ Besides the external aspect being so distinct that any observer will without difficulty separate them when seen together, the whole skeleton of our present species is more delicately formed, as are also the teeth. The form of the opercular bones is likewise different, and the length of the maxillary bones is much less in the *S. salmulus*, or *parr*, showing a very marked difference when the open mouths of the different fish are exhibited together. Another distinction is, the great width and power of the pectoral fins, evidently a special provision, as the principal organ of support in those rapid streams where this little fish is almost always found.

Although the history of the *parr* is still, in truth, obscure, we certainly deem ourselves authorized to state that it is not the young of the salmon. It may be found in rivers throughout the year, and is more especially abundant during those midsummer months in which the acknowledged young of the salmon is unknown except as a fish returning from the sea. The most characteristic and irrepressible instinct of the latter seems to consist in its descent to the sea a few weeks after exclusion from the egg; and if our summer *parr* is also the young of the salmon, the fact presents a very rare and remarkable ex-

ample of different individuals of the same species varying in their instinctive habits. The occurrence of *parr* in rivers so long after midsummer, and the entire disappearance of *smoults* (as the young salmon are sometimes called) anterior to that period, is a main argument in favour of their being distinct kinds; and we cannot get over the difficulty by simply asserting, that such as go down to the sea early are *parr*, and that such as go down late are *parr* also. It is admitted that the ova of salmon are hatched in spring, and that the growth of the young (by whatever name we choose to call it) is extremely rapid. Now, as nobody ever finds a *parr* above a few inches long (six inches is a large one), and as by the end of summer they must be several months old, how can we (in the belief of their being young salmon) reconcile their imputed age with their actual dimensions?² Still more difficult will it be to explain, in connection with that belief, how the brood which has descended seawards in the spring should, after the lapse of the same period, be found in their native rivers weighing many pounds.

The preceding are all the species belonging to our present group which have been yet ascertained to inhabit the waters of Britain. On the Continent of Europe we have the *S. lacustris*, Linn., found in the lakes of Lower Austria, and in the Rhine above Constance, and reaching to an enormous size.³

In the northern parts of North America, according to Dr Richardson, trout abound in every lake and river. In the *Appendix* to that gentleman's first expedition under Captain Franklin, the different varieties are all placed under *S. fario*, or common trout. It is doubtful, however, whether that species exists at all in America; and several species entirely distinct will be described in the third volume of the *Northern Zoology*, which have much of the colouring of some varieties of the European trouts, but differ remarkably in the smallness of the scales.⁴ Specimens of forty pounds in weight were seen; and in Lake Monito they were said to attain the weight of ninety pounds.

Another small group, which has hitherto been placed among the true *Salmones*, contains the fish commonly known under the name of *Char*. They differ from the trouts in the very small and narrower form of the scales, in the more delicate tootling (the vomer furnished with a single minute tuft at the tip, instead of being armed for its whole length), in the remarkably brilliant change which takes place during the season of breeding, a change very much more completely developed than in any of the other

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidæ.

¹ We would also suggest, as a good logical argument against the fact of *S. salmulus* being the young of the common salmon, that it is frequent in streams where salmon are scarcely ever seen. "What a pity it is," observes the Rev. George Low, "that I am almost obliged to deny the salmon a place in the Orkney zoology; yet true it is, that this noble fish is so seldom got here, that it is considered as a *wonder* when one is thrown ashore, or runs so far up one of our burns as to be taken. I have not heard of above three or four instances of salmon being taken in Orkney, three of which (if they were all salmon) were killed and brought on shore by the otter from the sea, and picked up by the country people, and a fourth which stuck in a mill-wheel, and was caught by the miller." The same writer, under the article *Parr*, observes, "Pretty frequent in the shallower lakes and clear burns, though not in such numbers as I have observed them in Scotland." (*Fauna Orcadensis*, pp. 220 and 223.) The reader will also bear in mind, that as we advance northwards in our own island, the *parr* becomes scarcer, the salmon more abundant,—and that while in the icy streams of the arctic regions the former has not yet been detected, the latter swarms in (elsewhere) unequalled numbers. It is scarcely worth while to allude to the opinion maintained by the late Sir Humphry Davy and others, that the *parr* is a hybrid or mule between the trout and salmon!

² We yesterday (14th September 1835), while angling in the North Esk, above the beautiful residence called The Burn, in Kincardineshire, killed about a dozen *parr*, two of which, measuring eight inches in length, were the largest we had ever seen. They were, however, as usual, spotted with red along the lateral line, and tinged all over the under parts, like trouts, with yellow. They exhibited no approach to the silvery character of the salmon, nor any departure from the usual aspect of the *parr*. The majority of the others were of the ordinary size, and some of them so small as to render it entirely incomprehensible—unless we are totally misinformed regarding the spawning periods of the salmon, and the time of its exclusion from the egg—by what process of reasoning they could be maintained to be the young of that fish.

³ We are not yet in a position to judge conclusively regarding the identity or distinction of the great lake trouts of Switzerland, and our own *Salmo ferax*. "La grande truite du Lac de Genève (*Salmo lenanus*, N.)," says Baron Cuvier, "qui se trouve aussi dans quelques lacs voisins, a la tête et le dos semés de petites taches rondes et noires sur un fond blanchâtre; sa chair est très blanche. Il y en a de quarante et de cinquante livres." (*Règne Animal*, ii. 303.) Now the gigantic tyrant of our Scotch lochs, to say nothing of other discrepancies, has the flesh of an orange hue.

⁴ The greater number of the plates for the volume above alluded to have been for some time engraved, and their publication, with the corresponding descriptions, will afford an important addition to the library of the Ichthyologist.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidæ.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidæ.

species, and in their food consisting in a great measure of minute entomostraca. The best and most familiar example of this group is the char of England.

Salmo umbla, Agassiz,—apparently confounded by most authors, in consequence of its great variety of aspect, and synonymous, according to the above-named naturalist, with *S. alpinus* and *salvelinus*, Linn. It is abundant in the English and Welsh lakes, and in the greater number of those in the north of Scotland, when of any considerable extent; but more seldom seen there, from the absence of the practice of *netting*. and the general unwillingness of char to take a fly or bait. This fish is of great repute in the Lake of Geneva, and is also found in many of the alpine lakes of northern Europe. The common char reaches a considerable size, being sometimes taken in Britain above two pounds in weight, although the more usual weight is under three quarters of a pound. When in full condition, it is a fish of very great beauty, above of a grayish green, shading into the most delicate white on the lower parts, and tinted with a blush which is comparable to that seen on the breasts of some of the gull tribe when newly shot in spring. The body is sprinkled over with pale spots of a considerable size. In this state they remain in the deeper parts of the lakes, and are not frequently taken, although we doubt not they might be so were the practice adopted of hanging a herring-net in the deep water, instead of trying only the *winter* practice of hawling in shore. We ourselves caught them by the former method, in their prime *silvery* state, in Sutherland, during the month of June. On the approach of the breeding time, they seek the mouths of the small tributaries, and are taken in vast numbers at the very period when their preservation ought to be most strictly attended to, and when, in truth, they begin to fall off in their condition. At this season the colour of the upper parts is darkened, the fins are very rich, and the sides and belly become of a beautiful and brilliant red, the whole spotted with small marks of a paler tint.

Although we here follow our friend M. Agassiz in placing the two supposed species under one denomination, yet we willingly admit, and indeed particularly desire our readers to remember, that the history of the char, whether single or distinctive, has not yet been clearly made out.¹ We have already mentioned (in the article *ANGLING* of this work) that both kinds occur in Windermere, to wit, the char or case char (*Salmo alpinus*), and the torgoch or red char (*Salmo salvelinus*). These are usually thus distinguished:—the former by having the first rays of the ventral and anal fins white; the latter by having those parts plain, that is, of the same colour as the other rays. A remarkable distinction is also observable in their natural habits,—the case char ascending rivers, and spawning about Michaelmas,—the red char depositing its ova along the shores of the lake, and not till the end of December or the beginning of the year.² Let these facts be duly regarded in determining upon the distinction or identity of species. We hope ere long to investigate the subject steadily. In the mean time, to illustrate the character of colour, we shall extract from our note-book some memo-

randa made a few seasons ago, on six specimens of char (supposed to exhibit examples of the different varieties or kinds) selected from a hawl taken (by net) in Windermere on the 12th December. “No. 1 is a very beautiful fish,—the ground colour of the body pale ashy brown, somewhat lighter beneath the lateral line. The sides are richly marked with scarlet spots of different sizes; the whole of the under surface, from the pectoral fins to the tail, are brilliant scarlet. The fins are margined anteriorly with an opake white stripe, followed by a blackish-brown portion, passing posteriorly into deep crimson. The tail is blackish brown. The nose and front part of the head are marked by a black spot. The dorsal fin is of the same pale-brown colour as the back, slightly inclining to blue.” This seemed a male. “No. 2 is a smaller fish, brown upon the back, and becoming gradually paler beneath; the abdomen and lower parts are dingy white, tinged with bluish colour. The ventral and anal fins are margined with white, their other parts flesh colour; the pectoral fins are reddish brown; the dorsal fin and tail blackish brown. The sides of this specimen are indistinctly marked with pale yellowish-red spots.” This was a male red char, which appeared to have spawned. “No. 3 is of a blackish-brown colour, somewhat silvery, paler beneath the lateral line, and passing into yellowish white on the belly. The pectoral, ventral, and anal fins are brown, tinged with red. The dorsal fin and tail are brownish black. The upper part of the head is also black. The sides of this specimen are distinctly marked with numerous very pale, almost colourless, spots. No. 4 resembles the last described, but is smaller.” These the fishermen called two *geld fish*, full grown and half grown. “No. 5 is a very dark fish, brownish black upon the back and sides, becoming, as usual, gradually paler beneath the lateral line. *The pectoral, ventral, and anal fins are distinctly margined* anteriorly with opake white; the central portion of these fins are brownish black, and their interior margins flesh colour. The upper part of the head is dark; the belly of a dingy red. No. 6 resembles the preceding, except that the under surface, instead of being dingy red, is pale reddish white. *The ventral and anal fins are reddish brown, margined anteriorly with white.* The pectoral fins are reddish brown, the dorsal fins are brownish black. Both these specimens are marked on the sides with obscure pale-reddish spots.” These two fish were what the fishermen called *case char* (*Salmo alpinus*?), male and female,—yet the pectoral, ventral, and anal fins of the former, and the ventral and anal fins of the latter sex, were conspicuously margined with white, although that character is usually regarded as distinctive of the torgoch or *red char*. Perhaps the fact of the male having the pectorals so margined, while those of the female were of uniform colour, may be regarded as of some importance, as tending to show that the character itself is in some measure variable, and therefore insufficient to constitute a specific distinction.³ Every angler knows that the under fins of the common trout are frequently margined on one edge with an opake line of milky white.

Although the art of angling is not immediately connect-

¹ We understand that Mr Yarrell has obtained what he considers as a second species of char, from Wales, which will be described in an early number of his *British Fishes*. We are as yet, however, uncertain whether he makes out the two common kinds to be identical, and has discovered a new species, or whether his observations merely go to prove that the said kinds (as formerly supposed) are distinct from each other.

² The chief feeder or head stream of Windermere is composed of two branches, the Brathay and the Rothay, which meet a short way above the lake, into which they speedily pour their united waters. The Brathay is the left-hand branch (as we ascend from the lake), and draws its sources from the mountain vales of Langdale, reaching Windermere without any resting place,—while the Rothay has previously formed and flowed from two consecutive lakes, Grassmere and Rydal. The char, in ascending from Windermere to spawn, invariably turn to the left, and ascend the Brathay (though to no great distance), and as invariably avoid the lake-descended waters of the Rothay. They also spawn lower down the Lake of Windermere, at the mouth (or a short way upwards) of the stream called Troutbeck, which is also derived from the flow of mountain tributaries, without any lesser or intermediate lake.

³ The specimens above alluded to are now deposited in the Edinburgh College Museum.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidæ.

ed with the science of Ichthyology, it is at the same time evident that the successful practice of that art necessarily illustrates the *food* of fishes, and therefore makes us acquainted with an important portion of their natural history. For this reason we insert the following memoranda, transmitted to us by Mr John Wilson, junior:—"The season for fishing char (with rod and line) in Windermere and Coniston commences about the end of May, and, I should say, is over by the first or second week in July. Trolling with a smallish minnow is by far the most successful mode of angling for this fish. It may, however, be taken with the artificial fly, the green and gray drake being the favourites. I killed three one day in May last with a small red *professor*.¹ A Bowness fisherman on the same day, trolling without intermission from six in the morning till six in the evening, killed *six and twenty*, being the greatest number that has been taken in Windermere, in a single day, by one person, for many years. In Coniston, where this fish is more abundant, I believe it is by no means uncommon to kill three or four dozen in a day. In regard to the size of char in Windermere, I should say they average three to the pound. I never saw one that was a pound. Billy Balmer told me that he once saw one that was a pound and a quarter, and that it was the largest ever taken in Windermere." In relation to the same subject, in a different locality, we may also add the following extract from another hand. "A small red char is found in Loch Achilty, Ross-shire, on the property of Sir George Mackenzie. It takes the fly greedily in warm, still weather, and, what is singular, during all the summer and autumnal months. I have captured eighteen in a forenoon in July,—raising many more. My flies were of various sorts, from a midge to one as large as a sea-trout fly. The water of Loch Achilty is singularly deep and transparent,—the soil is rich and loamy, and contains large quantities of imbedded wood,—black oak especially. It is supplied by numbers of minute streams, but has no visible outlet, being supposed to discharge itself subterraneously. The char found in it average eight or nine inches in length; we, however, caught one much larger. They rise with less velocity than the trout, and on missing the fly, unless injured, will return to the hook. In Strathglass there is a Loch Bruiach, where char are caught of a much larger size, but chiefly with the net,—except in the month of October, when, as our informant, the Rev. Mr Chisholm, told us, they may be taken in the shallows with the rod, but at no other season."²

On dissecting the char which we killed last summer in Sutherland, with a view to ascertain their food, we found the stomach usually empty, but the lower part of the intestine filled with green vegetable residuum. This we found to be the remains of the *cases* of aquatic larvæ (*Phryganidæ*), a few of which we discovered in a half digested state in the upper portion of the intestinal canal.

Following the preceding groups, or *Salmones* properly so called, Cuvier has placed the

GENUS *OSMERUS* of Artedi. Characterised by two rows of teeth on each palate bone, the vomer with a tuft on the fore part, the branchial membrane with only eight rays, the body without spots, and the ventral fins placed a little more forward than in the true salmon.

The best-known species is the *O. eperlanus*, Artedi., *Salmo eperlanus*, Linn.; called *spirlin* in Scotland. It is a small fish of delicate but brilliant colours, clear green on the upper parts, passing into silvery on the sides and belly. It frequents the sandy bays at the mouths of rivers,

which during the breeding season it ascends to spawn. It is abundant on the British coasts, and in many parts of Europe, and is taken in immense quantities, being much esteemed for the table.

GENUS *MALLOTUS*, Cuvier. Characterised by the teeth, which are fine, closely set, and nearly concealed; eight rays to the branchial membrane; the body lengthened and covered with minute scales; the first dorsal and ventral fins placed beyond the middle of the fish, pectoral fins very large and round; the male during the breeding season with the scales of the lateral line furnished with lengthened appendages resembling hairs.

The only species is *M. Groenlandicus*, Cuv.; *S. Groenlandicus*, Bloch; *Capelan*, or *Lodde*. A small fish of from four to seven inches in length, the under jaw longer than the upper; above of a greenish gray, changing to whitish below; and remarkable for the structure of the scales on the lateral line, and the size of the pectoral fins. Abundant in the Arctic Seas, where it is taken in immense profusion when approaching the coasts to spawn, and is used as the principal bait for cod. A few are cured and brought to this country in barrels, where they are sold, and used as a *relish by the curious in wines*.

GENUS *THYMALLUS*, Cuvier; *grayling*. Has been separated from the Guiniads, principally on account of the small scaling, and large dorsal fin. The species approach nearer in form, colour, habits, and food, to the trouts. They have the mouth with sides, that is, but slightly cleft, the teeth very fine, the body spotted, the branchial membrane with seven or eight rays. The stomach is very muscular. They inhabit rivers, and feed on aquatic insects, &c. England produces a beautiful species, commonly called the grayling, or

Thymallus thymus,³ Salvanus. The grayling delights in clear rapid streams, and is found in many of those bearing that character in the more hilly or mountainous parts of England, particularly in Shropshire, Yorkshire, and Derbyshire,—reaching as far north as some of the tributaries of the Tyne in Northumberland. The European range of this fish seems extensive, if all the authors are correct in their designation. According to the *Flora Lapponica*, it is common in Lapland, and the viscera are there used instead of rennet, with the milk of the reindeer. It is also found in Siberia, in Prussia, and Pomerania. It is a very beautiful fish, above of a dusky bluish green, changing to a fine silvery gray. The lower edges of the scales are dusky, which gives the appearance of dark streaks running along the fish. The most marked feature is the dorsal fin, of very large size, and darkly spotted between the rays, in the form of transverse bands. The ordinary size is from a foot to sixteen inches in length, but instances of one or two from four to five pounds are recorded. By some authors the grayling is said to be a migratory fish, passing the winter in the open sea, and the summer in the fresh waters. This may, however, be the habit of the fish in some countries only, as in certain of the English rivers they seem to remain during the winter. This species, as far as we know, appears to be the sole example of the form in Europe; and it is only seen again in North America, in a very beautiful fish, the

Thymallus signifer, Cuv.; *Coregonus signifer*, Richards. This grayling was met with by the expedition under Captain Franklin, in the strong rapids and clear rivers to the northward of Great Slave Lake, where it rose eagerly at artificial flies, and afforded good sport from its

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidæ.

¹ A noted fly, so named in honour of the Professor of Moral Philosophy in the University of Edinburgh,—a gentleman who is said to conjoin with various other accomplishments, considerable skill in angling.

² From the manuscript of Mr Thomas Tod Stoddart, an ingenious angler, of the Scotch bar.

³ So named from its supposed scent or flavour resembling thyme.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidæ.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidæ.

powerful motions in the water. Dr Richardson describes its sides as tinged with lavender purple, mixed with bluish gray, without streaks; the belly blackish gray, with several irregular white blotches; and there are five or six longitudinal rows of uniform quadrangular spots of Prussian blue on the anterior part of the body. There is a large blue mark underneath the lower jaw on each side. The dorsal fin, which forms a prominent feature in the fish, is of a blackish-gray colour, with some lighter blotches. Superiorly it has a narrow margin of light lake-red, and posteriorly it is beautifully ornamented with spots of Berlin blue. The ventrals are streaked with red, and with whitish lines in the direction of their rays. The scales are moderately large, and have no great lustre; their exterior margins are rotund and entire, or very slightly undulated, those on the anterior part of the belly being much smaller than the others. Of the fins the dorsal is the most extraordinary, being, according to Dr Richardson, "probably by far the largest in this genus." Its colours, as above mentioned, are beautiful, and, with its great size, form the chief ornament of the fish. It contains twenty-four rays; the first two or three are small; but the others increasing rapidly in height, as their origin is more posterior, become more and more branched, and cause the fin to play loosely like a flag over the posterior part of the body; the insertion of the fin occupies about one third of the length of the body, and the extremity of the posterior ray, which is five inches long, reaches as far as the adipose fin.¹ Specimens were taken sixteen inches in length. Another American grayling, found in the same northern localities, is the *Thymallus thymalloides*, Cuv.; *Coregonus thymalloides*, Richard. Resembles *Th. signifer*, but differs remarkably in the size of the dorsal fin. The body is compressed, and of a bluish gray, with purple reflections when moved in the light. The dorsal fin contains from twenty-two to thirty-four rays; but the posterior ones do not branch out in the same manner, and scarcely exceed the others in height; hence the fin has a very different aspect. It is about one inch high, has a dark bluish-gray colour, with several rows of spots, having purple centres and light-red borders. The usual length is eight inches.²

GENUS COREGONUS, Artedi. Distinguished from the last by the still finer teeth, larger scaling, and small dorsal fin; live in shoals in lakes or still waters, and only approach the edges during spawning time. Of delicate structure; feed much on entomostraca, and aquatic insects and their larvæ. Flesh white and delicate. The best-known British species is the Guiniad, or

Cor. lavaretus, *Salmo lavaretus*, Linn. Frequent in the lakes of Cumberland and Westmoreland, and also found in some of the Scotch lochs,—for example, Loch Lomond, where, as in the north of England, it is termed the *schelley*. According to the best authorities, it likewise occurs in those of Alpine and Northern Europe. It does not reach a very large size; the average may be stated from nine inches to a foot in length. The colours chaste and delicate, of a greenish gray above, changing to whitish, with a silvery lustre. The scales are of considerable size, and, when examined narrowly, are seen to be covered with minute black dots. It is used for the table, but is not so delicate as our other British species. It is known under the name of *fresh-water herring* in most of its localities.

Cor. marcanula, found in the Swiss lakes and some other parts of the Continent of Europe, is a small species, of nearly the same colours as the last. This fish was supposed to be found in some parts of Britain, and the *ven-*

dace of the Lochmaben lochs was thought referrible to it. When Scotch specimens, however, were shown to Mons. Agassiz during the autumn of 1834, he considered them distinct from the species known to the continental Ichthyologists as *C. marcanula*, and the title of *C. Willughbi* was suggested for the Scottish kind. Continental specimens of *C. marcanula* have not yet been received by us, and the distinctions, therefore, cannot at present be detailed. The *vendace* of Lochmaben, whatever scientific name it may ultimately receive, or whether it may be identical or not with the species inhabiting the lakes of Continental Europe, may be described as an interesting example of the genus. It is one of the most elegant, though of a small size, reaching from four to ten inches in length. The head is of an angular shape, and small compared with the size and depth of the body. The crown of the head is very transparent, and the form of the brain, which is heart-shaped, is seen through the integuments. This peculiarity is one of the first things pointed out to the stranger naturalist who visits Lochmaben to see this species. The eye is large and brilliant; the body rises gracefully to the back fin, and recedes with a gradual line to the tail; the under line is nearly straight from the gills to the ventral fin. The upper parts are of a delicate greenish brown, shading gradually into a clear silvery white; the dorsal fin greenish brown, the anterior edge much lengthened and pointed; the lower fins all bluish white; the tail much forked. They spawn about the commencement of November. The roe is minute and abundant, and of a bright orange colour. The flesh is white and rich, and highly prized as food; but as it requires almost to be *eaten on the spot*, it is not useful as a market commodity when transmitted to any considerable distance. The lochs of Lochmaben are the only authentic British habitat for this species.

Several other species inhabit the Swiss lakes, and are known chiefly from the works of the continental Ichthyologists, particularly M. Jurine, who has devoted a paper to the fishes of the Lake of Geneva. He there describes *C. fera* and *hyemalis* (the latter so named from its appearing only in winter); and Baron Cuvier notices a third from the Lake Neufchatel, under the title of *C. palæa*. In America several species are found in the lakes and rivers. The *white fish* of Dr Richardson seems to belong to the genus. It is the *C. albus* of Lesueur, and is called by the Cree Indians *Attihlawmegh*, a name corrupted to *Tittameg* by the traders. This fish attains a weight of from three (the ordinary size) to twenty pounds. It abounds in every lake and river, and is much esteemed as food, in many parts forming the sole article of diet for years together, without producing satiety. The stomach is of great thickness, generally filled with earth mixed with slender roots, and small white worms. It spawns in October. Another species is *C. quadrilateralis*, Richardson, of which the colour of the upper parts is intermediate between honey yellow and wood brown; the scales with a thin border of blackish gray round their exterior margins; the belly white, with a pearly lustre; the eye moderately large, the iris with a silvery hue; the mouth without teeth; the fins are yellowish; the adipose fin attached for its whole length. The stomach not thickened. The food small insects. Inhabits the Arctic Sea, and the small rivers about Fort Enterprise. The average size is about fifteen inches in length.

Under this division also appears to rank the *Inconnu* of Mackenzie and the Canadian Voyagers, although it is placed by Dr Richardson in the genus *Salmo*, under the name of *S. Mackenzii*. We therefore here record it as

¹ Richardson, in the *Appendix to Franklin's Journey to the Polar Sea*, p. 711.

² *Ibid.* p. 714.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidæ.

the *Coregonus Mackenzii*. The colour of the back and sides changeable from bluish to greenish gray, according as it is moved in the light. The belly bluish white; the scales sub-orbicular, four lines in diameter, and possessing much pearly lustre. From the form of the body, the size of the scales, the fineness of the teeth, and their distribution, this fish evidently belongs to the genus *Coregonus*. It reaches a weight of thirty or forty pounds. The flesh is white but agreeable. It is found in Mackenzie's River, and the lakes and streams which flow into it; also in Salt River, which, however, is its most southerly limit.¹

GENUS ARGENTINA, Linn. The mouth small, depressed horizontally; no teeth on the jaws, but with a small tuft on the vomer, and having the tongue with teeth rather strong and hooked, as in the trouts. Six rays to the branchial membranes. The internal structure as in the trouts. The genus is composed of a single species, the

Arg. sphyrena, Linn. Found in the Mediterranean sea, and remarkable for the thickened coats of the swimming bladder, which, as well as the scales, is plentifully charged with that silvery secretion used in the manufacture of "*l'essence d'orient*," an article employed in the formation and lustre of false pearls. For this purpose the species is fished in great numbers along the coast of Tuscany. It is a small fish, scarcely exceeding four or five inches in length, of delicate tints,—the integuments being transparent, and giving a clear brilliancy to the colours. The upper parts are grayish, the sides and lower surface of a brilliant silvery lustre.

Following this fish, Cuvier adopts the genus CHARACINUS of Artedi, as a group to contain all the species of the Linnæan *Salmones*, which have only four or five rays to the branchial membrane, but as the form, toothing, &c. vary in most of these fishes, he has thought it necessary to subdivide them into subordinate genera. It is remarkable that many of them have the cæcal or pancreatic appendages, and at the same time the narrowing or girth of the air-bladder, which is seen in many of the Cyprini. The first subdivision is

GENUS CURIMATA, Cuv. In form the species resemble *Thymallus*. The teeth are, however, variable, and the divisions of this group may yet require examination. The number of branchial rays not exceeding five, must be remembered; some of the species, with the exception of that distinction, approaching very nearly to the genus just named. They inhabit the rivers of South America. As an example may be noted a new species, the *Curimata Gilbert* of Quoy and Gaimard. This fish somewhat resembles a small *Cyprinus*, but is distinguished, even on a superficial view, by the presence of the adipose fin. The scales are rather large in proportion; the upper parts are bluish gray, changing into silvery; the fins yellowish; the body appears spotted, or rather blotched, with indistinct dark markings, conspicuous only when placed in particular lights. This species was discovered in the fresh waters of Brazil, near the river Macaca, and appeared to prefer those places which were of a marshy character.

GENUS ANASTOMUS, Cuv. Characterised by combining with the form of the graylings a mouth cleft somewhat vertically, and furnished with fine teeth. It contains a single species, a native (it is said) both of South America and India, the *Salmo anastomus*, Linn. Is it not likely that two species are confounded here?

GENUS GASTROPELECUS, Bloch. With the mouth

placed vertically as in the last, but with the belly compressed. The ventral fins very small, and placed far back. The first dorsal fin placed above the anal, which is very long. Conical teeth in the upper jaw, in the lower sharp and cutting.

Gast. sternicla, Bloch, is a very small species, scarcely two inches in length, which inhabits the waters of Surinam. Its form is very much compressed, and sharply carinated beneath; above bluish gray; beneath silvery.² The fins gray, ventrals extremely minute, the anal extending nearly from them to the tail; the tail much forked.³

GENUS PIABUCUS, Margrave? Characterised by a lengthened form; a small head, with the mouth deeply cleft and armed with strong teeth. The body compressed; the belly carinated, but smooth; the anal fin much extended. The species inhabit the rivers of South America, and are carnivorous and voracious.

P. bimaculatus. About four inches in length by about two in breadth. Above brownish, lower parts silvery; fins pale yellow; on each side of the body beyond the gills an oval spot of black, with a similar one at the base of the tail. Inhabits the rivers of Surinam, and is esteemed as food.⁴

GENUS SERRASALMUS, Lacépède. The body compressed; the belly carinated, and toothed or serrated on its lower margin; the teeth triangular and cutting; some species with a concealed spine before the first dorsal fin.

Ser. rhomboides, Bloch. Above of a dusky red, marked with a few small scattered dusky spots; sides and belly silvery, the latter strongly carinated and serrated by a series of aculeated processes. The fins yellowish; tail terminated by a black border. Found in the rivers of Surinam, where it reaches a considerable size; feeds on fish and *water-fowl*! Two other species, *G. aureus* and *nigricans*, are figured in the work of Spix.

GENUS TETRAGONOPTERUS. This group was formed by Artedi, and after being thrown out by Ichthyologists, was re-established by Cuvier as a sub-genus. The form continues compressed, the anal fin much extended, and the teeth sharp and cutting; but there are two rows of teeth on the upper jaw, and the belly is neither carinated nor serrated, as in the preceding.

GENUS CHALCEUS, Cuvier. Characterised by the same form of the mouth, and the same cutting teeth, as the preceding fishes; but the body is of an oblong form, and neither carinated nor serrated beneath. The maxillary bones have three small round teeth. Inhabit South America. The species are *C. macrolepidotus*, Cuv., and *C. angulatus*. Spix.

GENUS MYLETES, Cuvier. Characterised by the singular form of the teeth, in the shape of a triangular prism, short, rounded at the corners, and with the upper surface so hollowed by mastication, that the three angles form three projecting points. The mouth small, with two rows of teeth on the inter-maxillary bones. None on the maxillaries. The under jaw with a single row of teeth. The form elevated; a spine before the vertical fins. The belly carinated and serrated. Inhabit America and Africa. Some of the species attain to a large size, and have the flesh well flavoured.

M. Hasselquistii, Cuv., *Salmo dentex*, Hasselquist, is found in the Nile. It is a fish of a lengthened form, with the dorsal fin occupying the position which corresponds to the space between the ventral and anal fins. The teeth are very strong. The colours above are brownish, with three or four indistinct longitudinal lines upon the sides; the under parts silvery.⁵ *M. paco* is an American species.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidæ.

¹ Richardson in the *Appendix to Franklin's Journey to the Polar Sea*, p. 707.

² Schneider.

³ Shaw.

⁴ Schneider, Shaw.

⁵ Schneider.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidae.

Malacop-
terygii
Abdomi-
nales.
Salmo-
nidae.

GENUS *HYDROCYON*, Cuvier. Extremity of the muzzle formed by the inter-maxillary bones; the maxillaries commencing near or before the eyes, and completing the upper jaw. The tongue and vomer always smooth, but there are conical teeth on both jaws. A large sub-orbital bone, thin and bare as the opercle, covers the cheek.

Certain species have a close row of small teeth on the maxillary and palatine bones, the first dorsal fin corresponding to the space between the ventral and anal fins. They are of agreeable taste, and inhabit the rivers of the torrid zone. To this group belongs the *Hyd. fulcatus*, Quoy and Gaim. Above of a violet tint, beneath pale, but tinted generally with a shade of silvery. A silvery band extends the whole length of the body from the opercle to the tail, and at each extremity is marked with a dark spot. The fins gray at the base, and brown at the extremity. The eyes of a golden red. The scales small and deciduous. The specimens brought by Freycinet were from five to six inches in length. They were taken in Brazil.

Other species have a double row of teeth on the inter-maxillaries and lower jaw, a simple row on the maxillaries, and none on the palatine bones. The first dorsal fin is placed above the ventrals. A Brazilian species, *H. brevidens*, Cuv., exemplifies this minor group.

Others again have only a simple row of teeth on the maxillaries and lower jaw, but the teeth are alternately small and very large, especially the two second from below, which pass through hollows of the upper jaw when the mouth is shut. The lateral line is composed of scales of a larger size, and the dorsal fin is so placed as to correspond to the interval between the ventral and anal fins. *H. scomberoides*, Cuv. or *Cynodon vulpanus*, Spix, is an example of this peculiar form.

Another form has the muzzle pointed, the maxillary bones very sharp, and the inter-maxillaries and lower jaw furnished with a single row of very close, small teeth; the body covered with strong scales. A Brazilian species, *H. lucius*, Cuv. affords a characteristic example.

A fifth form has teeth only on the inter-maxillaries and lower jaw, and these few in number, but strong and pointed. The first dorsal fin is placed above the ventrals. A single species from the Nile, the *Characinus dentex* of Geof. (*Pois. d'Egypte*), presents the sole example of this limited group.

GENUS *CITHARINUS*, Cuvier. Characterised by their depressed mouth, the upper edge formed entirely by the inter-maxillary bones. The maxillaries small and without teeth; the tongue and palate smooth; the adipose fin covered with scales, together with the greater part of the tail. The species inhabit the waters of Africa.

Some have the upper jaw only furnished with very fine teeth; the body elevated as in *Serrasalmus*, but without the carinated or serrated abdomen.

Salmo cyprinoides exemplifies this division of the genus. Others have on both jaws a number of teeth, thickly placed in several rows. These fish are more lengthened in their form, and appear to lead to the next genus. *Salmo Ægypticus*, Linn. serves as an illustration.

GENUS *SAURUS*, Cuvier.¹ Distinguished by its lengthened and cylindrical form, and by the large scales, which cover also the cheeks and opercles. The edges of the upper jaws are formed entirely by the inter-maxillaries; and on each, as well as on the palatine bones and the tongue, are numerous pointed teeth, which are wanting on the vomer. The first dorsal fin is placed much posterior to the ventrals, which are large. The interior struc-

ture resembles that of the trouts. They are very voracious.

This form is illustrated by the *Salmo saurus* of Bloch and Linn., a native of the Mediterranean; above of a greenish blue, varied with numerous narrow undulated transverse bands, reaching as far as the lateral line, which is itself bounded beneath by a continued stripe of brown; abdomen silvery. The fins pale, the pectorals crossed with a few brown bars.²

S. variegatus, Lacépède, Quoy, and Gaimard. The jaws, tongue, and palate with formidable sharp teeth. The upper parts of a dull gray, banded transversely with eight or nine brown bands, broad and irregular when ceasing at the centre of the fish. The under parts tinted with rose colour. The eye red and brilliant. In this fish the second dorsal fin is so small as not easily to be perceived. Found in the neighbourhood of the Sandwich Isles.³

S. gracilis, Quoy and Gaimard. A small species, reaching only about four inches and a half in length. The colours are unobtrusive, being a dull gray blotched with irregular blackish spots, most defined on the sides and towards the tail. All the fins are covered with brownish specks, which on the pectorals are so disposed as to form three transverse bands. This fish was also found in the neighbourhood of the Sandwich Isles.⁴

GENUS *SCOPELES*, Cuvier. Mouth and opening of the gills wide; the jaws furnished with very fine teeth; the upper jaw formed entirely by the inter-maxillaries; the tongue and palate smooth; the branchial rays from nine to ten; the adipose fin small, but having a trace of bony rays. The species are small in size, and live in shoals. They are found in the Mediterranean Sea. The *Sc. Humboldtii* of Risso offers a characteristic example.

GENUS *AULOPUS*, Cuvier. In this form the characters of the *Cod* or *Gadi*, and *Salmones*, are united. The mouth is widely cleft, the inter-maxillary bones, which form the border of the upper jaw, are furnished, together with the palatine bones, the vomer, and the lower jaw, with a narrow stripe of teeth *en carde*. The maxillary bones are longer, and without teeth. The ventral fins are placed almost under the pectoral fins, and have the outer rays strong, and simply forked. The body, cheeks, and opercles, are covered with large ciliated scales. *Salmo filamentosus* of Bloch illustrates *Aulopus*.

GENUS *STERNOPTYX*, Herman. These curious fish have by Cuvier been placed under the above title at the conclusion of his Salmonidæ. They embrace two forms, which, he thinks, will eventually be converted into sub-genera. They are of small size, the body high, and very compressed; the mouth directed upwards. The humeral bones form on the fore-part a sharp crest or ridge, terminated below by a small spine. The pelvic bones form another and similar crest, also terminated by a small spine placed before the ventral fins, which are so minute as to have escaped the observation of the first observer. On each side of the last ridge there is a row of small hollows, which has been regarded as a fold of the sternum, and has suggested the name of *Sternoptyx*. Before the dorsal fin there is a bag or membranous ridge, and behind this fin there is a small membranous projection, which is thought to represent the adipose fin of the true Salmones.

The first form of this genus has very fine teeth, with five rays to the branchial membrane, and is represented by *St. Hermannii*. The second has the teeth hooked, and nine rays to the branchial membrane. *St. Olfersii* exhibits the only known example. Both species are from the warmer parts of the Atlantic Ocean.

¹ Named from their lengthened Saurian or lizard-like form, and distinguished from the other groups derived by Cuvier from the genus *Characinus* of Artedi, by the branchial rays ranging from eight to fifteen in number.

² Shaw, *General Zoology*, vol. v.

³ *Voyage de Freycinet*.

⁴ *Ibid.*

Malacop-
terygii
Abdomi-
nales.
Clupidae.

FAMILY V.—CLUPIDÆ.

Fishes allied to herrings are easily recognised by their having no adipose fins; their upper jaw is formed as in trouts,—in the middle by inter-maxillary bones without pedicles, and on the sides by the maxillary bones; their body is always very scaly. The majority of the species possess a swimming bladder and numerous cæca. Those which ascend rivers are comparatively few in number.

The great genus *CLUPEA* of Linnæus may be known by two well-marked characters; 1st, by the narrow and short inter-maxillary bones, which constitute only a small portion of the upper jaw, the sides of which are completed by the maxillaries in such a way that the lateral parts only are protractile; and, 2d, by the compressed and sharp inferior edge of the body, upon which the scales project like the teeth of a saw. Besides, the maxillaries are divided into three pieces. The branchial openings are very much cleft; and hence these fishes speedily die when removed from their native element.

Their branchial arches are furnished on the side next the mouth with pectiniform dentations. The stomach has the form of an elongated pouch; the swimming bladder is long and pointed, and in some species sends forwards two long and small processes, which communicate with the internal ear in a remarkable manner. Their cæca are numerous. Of all fishes, these have the most numerous and the finest bones.

GENUS *CLUPEA*, Cuv. Herrings, properly so called. The maxillary bones arched anteriorly, and longitudinally divisible into several pieces; the opening of the mouth of moderate size; the upper lip not emarginate.

C. harengus, Linn. The common herring; *le Hareng*, Fr.; *der Häring*, Ger. This well-known fish has visible teeth in both its jaws; the carina of the belly is but slightly marked; the sub-opercle is rounded; there are veins on the sub-orbital, pre-opercle, and upper part of the opercle. The attachment of the ventral fins corresponds to the middle of the dorsal; the head is one fifth of the length of the whole fish, and by carrying backwards from the first dorsal fin the distance of that organ from the snout, we arrive at the middle of the caudal. The anal fin has sixteen rays.

The investigation of the habits of this fish has not received that attention which its importance as an article of food to the inhabitants of this country demands; and there are several circumstances respecting its economy which still require farther examination. It is generally believed that the herring inhabits in winter the depths of the Arctic Ocean, or other seas in northern latitudes, and that during the rest of the year it makes migrations southwards. In summer and autumn they appear on the north and west coasts of Europe in immense shoals, and about the same season they arrive at some parts of the coast of America and Asia. It has been supposed that those coming from the north divide into two detachments, one of which proceeds along Newfoundland to America, the other along Norway to the south of Europe, and that one subdivision of this second detachment goes up the Baltic, while the other proceeds along Great Britain, Ireland, Germany, and France, as far as the western coast of Spain.

This is the description of the annual migrations of the herring given by Pennant; but some doubts have been entertained as to its accuracy, from the circumstances, 1st, that while in some places the herrings do not make their appearance for years, in others they are taken in abundance all the year round; and, 2d, that they have never been observed on their return northwards. Other naturalists

suppose that they come merely from the deep into shallow water during the spawning season, and that in so doing they do not make any very lengthened journeys. In truth, we are not as yet furnished with sufficient data to decide the question; but, in the mean time, we do not feel inclined entirely to reject the generally received opinion, that the herrings migrate from north to south in summer and autumn.

In migrating, the herrings proceed in vast troops,—so great, indeed, that the sea is sometimes covered with them for miles, and that they have even been known to be stranded or crushed in immense quantities in confined bays, or when thrown by the wind or by currents upon the shore. The shoals are said to be generally preceded, sometimes for days, by one or two males. The largest generally go first, to act in some measure as guides; and, as they proceed onwards, immense numbers fall an easy and unresisting prey to rapacious birds, or to their own not less rapacious kindred of the sea.

It is generally believed that the herrings captured far north are larger, fatter, and of a better quality, than those of the south; and for this reason, in the month of July, our fishermen go out to meet the shoals as far as Orkney and Shetland. The greatest number are taken on the coasts of Norway and Sweden, in the first of which countries it is said that about 400 millions are taken in one year, and sometimes twenty millions in a single fishery. The inhabitants in the neighbourhood of Gothenburg, in Sweden, take as many as 700 millions in a year. Herrings are fished also in great quantity in this country, Germany, France, Holland, the United States, and Kamtschatka.

The average size of the herring is stated to be about ten inches. According to Dr Knox, the females are considerably larger than the males,—the largest female he found on the east coast of Scotland measuring eleven inches, the largest male nine inches and a half. It does not appear to be precisely known at what age they attain their full size.

Considerable doubt has at all times prevailed regarding the food of the herring. They were generally stated to live on small crabs and fishes, and on a minute crustaceous animal named by Fabricius *Astacus harengum*. But this was chiefly matter of supposition, for most practical fishermen described the stomach of the fish when in good state as quite empty, or, at most, as containing a little brownish mucus; and it has appeared difficult to reconcile the fact, that it is when the stomach appears thus empty that the fish is in its best condition, viz. fullest, with the finest flavour, and most capable of keeping,—with the notion, that when it appears upon our coasts it has quitted its natural feeding ground, and has been longer and longer in a state of starvation the more southern the latitude in which it is found. Dr Knox's interesting observation, that the principal food of the salmon and vendace consisted of minute crustaceous animals, led him to examine carefully with the microscope the brownish matter contained in the alleged empty stomachs of the herring; and he then formed the opinion, that this matter consisted of the debris of a very minute entomostracous animal.¹

It is well known that the herrings caught upon the east coast of Scotland are much inferior to those taken on the west coast, and more particularly to those of Loch Fine, and other lochs of Argyleshire. Dr Knox states that the herrings taken near the Firth of Forth in July are foul, or are engaged in spawning, while those of the west coast, in the same season, have the organs of reproduction very slightly developed; and he conjectures that that species of crustaceous animal which forms their appropriate and most favourite food may exist abundantly in the bays on the west coast of Scotland, and either not at all, or not in

Malacop-
terygii
Abdomi-
nales.
Clupidae.

¹ It is figured in the *Edin. Phil. Trans.* vol. xii. pl. x.

Malacop-
terygii
Abdomi-
nales.
Clupidae.

sufficient quantities, along our eastern coasts. It appears to be chiefly after these fishes have been absent for some time from their proper feeding places that they eat marine worms and small fishes; and when so feeding they lose much of their flavour, and run rapidly into putrefaction after being captured. The time of spawning seems to vary considerably, both in the same and in different districts; so that we may have spring, summer, and autumn herrings, as we know they have in some parts of the Baltic. During the spawning season they are seen to rub their bellies against the rocks or sand. As many as 68,606 eggs have been counted in one female. The young do not accompany the larger herrings in their migrations.

Of the genus *Clupea*, Cuvier makes four other species besides the common herring, viz. the *sprat*, *white-bait*, *pilchard*, and *sardine*. Of these we shall now give a short account.

Clupea sprattus, Bl. The sprat, mellet (*Espot*, *Haranquet*, Fr.), bears a very close resemblance in form to the herring, but does not attain the same size. The number of its vertebrae is forty-eight, and the dorsal fin is placed farther back than in the herring. It has no veins on the opercle; a gilded band runs along the sides in the spawning season. This fish is eaten in considerable quantity in this country, both in the fresh and salted condition. It appears in the Thames from November to March.

Clupea latulus, Cuv. White-bait (*Blanquette*, Fr.; *die Breitling*, Germ.) has the body more compressed, and the belly sharper, than the herring. The length of its head, and height of its body, are each one fourth of the whole length of the fish. The dorsal fin is placed farther forwards, the anal is longer and situate nearer the caudal fin, than in the herring.

Considerable difference of opinion formerly existed among ichthyological writers as to the exact specific nature of the white-bait. Pennant and Shaw considered it as allied to the bleak, *Cyprinus alburnus*. Turton, Donovan, and Fleming, regard it as the young of the shad *Clupea alosa*, an opinion which was generally received as correct, until Mr Yarrell in 1828 ascertained that the number of vertebrae in the white-bait is invariably fifty-six, and in the shad only fifty-five; and he is thus supposed to have demonstrated that the well-known *white-bait* ought to be regarded as a species distinct from every other. It is a very small fish, seldom exceeding four inches in length. It is of a very brilliant silvery colour, and has a black spot on the end of the snout. The flavour of the white-bait is considered as particularly delicate, and great numbers are eaten by the Londoners in the month of July, at which time innumerable quantities make their appearance in the Thames.

Clupea pilchardus, Bl. The pilchard (*le Célan*, Fr.) nearly equals the herring in size, and bears a considerable resemblance to it in form. The sub-opercle is quadrangular, the pre-opercle and opercle striated; the head proportionally shorter than in the herring, and the dorsal fin placed farther forwards. The ventral fins begin as it were under the end of the dorsal; the anal consists of eighteen rays; and on each side of the caudal two scales longer than the rest project. The habits of this fish seem to be nearly the same as those of the herring. It is believed, like it, to reside in winter and spring in the northern seas, and to proceed southwards in the beginning of summer. It is fished in enormous quantities off the coast of Cornwall for the purpose of salting and exporting to the Mediterranean, especially to Naples. It appears there in July. Its flavour is considered by some as even superior to that of the herring.

Clupea sardina, Cuv. The sardine, which is esteemed for the extreme delicacy of its flavour, differs only in size from the pilchard. Numbers are taken off the coast of Brittany, and also in the Mediterranean.

GENUS *ALOSA*, Cuv. This genus is distinguished from the herrings properly so called, by an emargination in the upper jaw; its other characters seem in all respects the same as those of the pilchard and sardine.

Alosa vulgaris, Cuv.; *Clupea alosa*, Linn. Plate CCCV. fig. 2. The shad is distinguished by the absence of sensible teeth, and by an irregular black spot behind the gills. This fish is much larger than the herring, attaining sometimes to the length of three feet. It is also of a much flatter shape; its tail is much forked; and on each side of the lower margin of the belly the scales are very large. It is a native of the Mediterranean, as well as of the North Atlantic and Caspian Seas. According to Pennant, the best in this country are found in the Severn. The shad ascends rivers in spring and the beginning of summer, and it is then highly esteemed; but it is of a dry and disagreeable flavour when taken at sea. The Russians believe that the shad has deleterious properties. The Arabs smoke-dry it. This species lives chiefly on vermes, insects, and small fishes; and Dr Fleming informs us that he has taken small herrings from its stomach. The number ascending rivers varies very much in different years.

Alosa finta; *Clupea finta*, Lacép. The *veuth* of the Flemish is more elongated than the shad, and has well-marked teeth in both jaws; there are five or six black spots along the flanks. It is found as far south as the Nile. Its taste is very inferior.

GENUS *CHATOESSUS*, Cuv. The *chatoessi* are true herrings, with the last dorsal ray prolonged into a filament. Some have the jaws equal and the snout not prominent, and a small mouth devoid of teeth. In others the snout is more prominent than the jaws; an equally small mouth with the preceding; the upper combs of the first pair of gills unite together so as to form a very singular pennated point beneath the palate.

At the end of the true herrings Cuvier has placed some foreign genera which resemble them in their sharp and dentated belly.

GENUS *ODONTOGNATHUS*, Lacép.; *Gnathobolus*, Schn. Has the body much compressed, and very sharp dentations along the whole of the belly; the anal fin long, and projecting little; the dorsal so brittle as to be almost always destroyed; six rays in the branchial covers. The maxillary bone is somewhat prolonged into a point, and is armed with small teeth directed forwards. There are no ventral fins.

One species only is known. It comes from Cayenne; resembles a small sardine, and is called by Lacépède the *Odontognathe Aiguillonné*.

GENUS *PRISTIGASTER*, Cuv. Has the head and teeth similar to those of the herrings; four rays to the gill-covers, and no ventral fins; the belly much compressed, its lower edge arched, and sharply dentated.

The *Prist. tardoore* and *Prist. cayanus* are mentioned by Cuvier as known species existing in both oceans.

GENUS *NOTOPTERUS*, Lacép. Was placed among the *Gymnoti* for some time, on account of a resemblance occasioned by the extreme length of the anal fin. The species have scaly cheeks and opercles; the sub-orbitals, lower part of the pre-opercles, the inter-opercles, the two crests of the lower jaw, and the keel of the belly, dentated; there are fine teeth in both palates and jaws, and strongly hooked teeth on the tongue. The branchiostegous membrane has only one strong osseous ray. There are two very small ventral fins, followed by an anal, which occupies three fourths of the whole length of the fish, and united as in the *gymnoti* to the caudal fin. A small dorsal fin with soft rays is placed opposite to the middle of the caudal.

One species only is known, inhabiting the fresh-water ponds of the East Indies.

Malacop-
terygii
Abdomi-
nales.
Clupidae.

Malacop-
terygii
Abdomi-
nales.
Clupidae.

GENUS ENGRAULIS, Cuv. The *Anchovies* differ considerably from the true herrings in having the mouth cleft far behind the eyes; the gills more open, with twelve or a still greater number of rays; the maxillaries straight and elongated, and there projects in front of the mouth a small pointed muzzle, under which are fixed very small inter-maxillaries.

The best known have not the sharp-edged belly; their anal fin is short, and the dorsal is placed opposite to the ventrals.

Clupea enerasiculus, Linn. The common anchovy (*l'Anchois*, Fr.) has the back of a bluish-brown colour, the belly silvery. It measures from four to seven inches long. The anchovy formed one ingredient of the *garum*, a favourite sauce of the Romans; and when pickled it is much prized at the present day. It is fished in greatest quantity in the Mediterranean, but is found as far north as the coast of Holland. It lays its spawn near the shore, from December to March, at which time it is supposed to leave the deep sea and approach the coasts. *Engraulis melella*, Cuv., an inhabitant of the Mediterranean, is smaller than the common anchovy. Among some remarkable American species of this genus, the *Eng. edentulus* is without teeth. Others, as the *Clup. atherinoides*, *Clup. telara*, and *Clup. phasa*, have the body compressed, and its lower edge serrated.

GENUS THYSSA, Cuv. Differs from the last-mentioned anchovies only in the great prolongation of the maxillaries. The species occur in the East Indies.

GENUS MEGALOPS, Lacép. Differs from the herrings in having the belly blunt, and the body not compressed. The jaws and palatine bones are covered with small, even, sharp teeth; there are from twenty-two to twenty-four rays in the gill-covers; and the last ray of the dorsal fin, as also often that of the anal, is prolonged into a filament, as in *Chatoessus*.

One species is found in America, the Savalle or Apalike (*Clup. eyprinoides*, Bl.), which attains the enormous length of twelve feet; it has fifteen dorsal rays. Another Indian species, *Megalope filamenteux* of Lacép., has been confounded by Russel with the preceding, under the name of *Apalike*. Its dorsal fin has seventeen rays.

GENUS ELOPS, Linn. Is very similar in structure to *Megalops*, but wants the elongated filament of the dorsal fin. It has thirty or more rays in the branchiostegous membrane; a flat spine on the upper and lower edge of the caudal fin. The species are found in both hemispheres.

Elops saurus is described by Sir Hans Sloane as belonging to America. According to Cuvier, the *Argentina machnata*, Forsk., *Mugil salmoneus*, Forsk., the *Tinagow*, Russ., *Synode chinois*, Lac., *Mugil appendiculatus*, Bosc, the *Pounder*, Sloane, and the *Argentina Carolina*, Linn., are all the same as *Elops saurus*, while the *Saurus maximus*, usually confounded with it, belongs to a different genus.

GENUS BUTIRINUS, Commerson. Muzzle prominent like that of the anchovies, and the mouth slightly cleft; twelve or thirteen rays on the branchiostegous membrane; close and even teeth on the jaws; and (a peculiar character) the tongue, vomer, and palatines closely paved with rounded teeth. These fishes are described under various names by different authors.

The *Elopes* and *Butirini* are found in both oceans. They are pretty, silvery-looking fishes, and make excellent soup.

GENUS CHIROCENTRUS, Cuv. Have the jaws formed like those of the herrings; both maxillaries and inter-maxillaries furnished with strong conical teeth, two of which above and all below are very long. The tongue and branchial arches are bristled with teeth like a comb, but there are none on the vomer or palatines. Their gill-

covers have seven or eight rays, of which the external are very broad. Above and below each pectoral fin is a long, pointed, membranous scale, and the rays of those fins are very hard. The body is elongated, compressed, and sharp beneath, but not serrated. The ventral fins are very small, and the dorsal shorter than the anal, opposite to which it is placed. The stomach forms a long, narrow, and pointed sac, the pylorus being near the cardia; no caeca; the swimming bladder long and narrow.

One species only is known, of a silvery hue, and from the Indian Ocean. It is the *Esoce chirocentre*, Lac., *Clup. denter*, Schn. and Forsk., *Clup. dorab*, Gmel., *Wallach*, Russ., and probably also the *Parring* or *Chnees* of the Moluccas.

GENUS HYODON, Lesueur. Possesses the general form of the herrings, and their sharp belly, but that part is not serrated. The dorsal fin is placed opposite to the anal; the gill-covers have eight or nine rays; hooked teeth on the vomer; palatines and tongue as in trouts.

Those which are known live in the fresh waters of North America.

GENUS ERYTHRINUS, Gronov. A range of conical teeth in each jaw, some of which in front are longer than the rest; the palatines are covered with close even teeth. The gill-covers have five broad rays; the head is without scales; and the cheeks covered by hard sub-orbitals. The body long, little compressed, covered with large scales like those of the carp. The dorsal fin is placed above the ventrals. The stomach forms a broad sac, and there are numerous small caeca. The swimming bladder is very large.

We may mention as a characteristic species the *Esoz Malabaricus* of Bloch.

These fishes inhabit the fresh waters of warm climates. Their flesh is agreeable.

GENUS AMIA, Linn. Similar to the preceding in many respects, but with twelve rays in the gill-covers. Below the lower jaw is an osseous buckler, which exists also in *Megalops* and *Elops*, though of smaller size in those genera. The dorsal fin, beginning between the pectorals and ventrals, extends nearly to the caudal; the anal is short. Each nostril has a small tubular appendage. The stomach is ample and fleshy; the intestine without caeca. The swimming bladder is cellular, like the lung of a reptile.

Only one species, *Amia calva*, is known. It resides in the rivers of Carolina, where it feeds on crabs. It is seldom eaten.

GENUS SUDIS, Cuv. The characters of this group are nearly the same as those of *Erythrinus*, excepting that their body is proportionally longer, and the dorsal and anal fins are placed opposite to each other, and, nearly of an equal size, occupy the posterior third of the length of the body. The species live in fresh water.

Three kinds are now known. One, *Sudis Adansonii*, Cuv., was found in Senegal by Adanson, and in the Nile by Rüppel. Another, of a much larger size, with great bony scales and an oblong muzzle, is a native of Brazil,—the *Sudis gigas*, Cuv. A third, *Sudis Niloticus*, discovered by Ehrenberg in the Nile, has a singular spirally convoluted funnel adhering to the third gill, which may be analogous to what has been observed in *Anabas* and neighbouring genera.

GENUS OSTEOGLOSSUM, Vandelli. Distinguished from *Sudis* principally by two barbels, which depend from the symphysis of the lower jaw; the anal and caudal fins are united. The tongue is rendered very rough by a covering of short straight teeth, so that it may be used as a rasp to reduce fruits to a pulp.

Osteoglossum Vandellii, Cuv., is a native of Brazil.

GENUS LEPISOSTEUS, Lacép. Muzzle formed by the union of the maxillaries, inter-maxillaries, and palatines, with the vomer and ethmoid, which the lower jaw equals in length. The jaws have along their edge a row of long

Malacop-
terygii
Abdomi-
nales.
Clupidae.

Malacopterygii Sub-brachiati. Gadidæ. and pointed teeth, and their inner surface is rendered bristly by a covering of sharp, rasp-like teeth. The gill-covers are united below by a common membrane, having three rays on each side. These fishes are covered with scales of a stony hardness. The dorsal and anal fins, which are opposite to one another, are both situate very far back. The two outer rays of the tail, and the first ray of all the other fins, are furnished with scales so as to make them appear dentated. The pylorus has many short cæca. The swimming bladder is cellular, as in *Amia*.

There appear to be several species or varieties of this fish. They inhabit the rivers and lakes of the warm parts of America. They grow to a considerable size, and are considered to be good eating. Dr Fleming observes, that the claims of *Lepisosteus osseus* to rank as a British species are very doubtful. Berkenhout indeed has inserted it in his *Synopsis* (p. 81), with the habitat of *Sussex coast*; and Mr Stewart, in his *Elements of Nat. Hist.* (vol. i. p. 374), intimates its occurrence in the Firth of Forth; but we are not aware of its having been seen among us in recent times. We here figure the *Lepisosteus spatula* of Lacépède (*Esox Cepedianus*, Shaw), a native of the seas and rivers of America. Plate CCCV. fig. 4.

GENUS POLYPTERUS, Geoff. Distinguished at once from other genera by a number of separate fins placed along the back, each supported by a strong spine, to the posterior edge of which are attached some soft rays. The caudal fin surrounds the end of the tail, and the anal is very near it; the ventrals are very far back. The body is covered with bony scales like those of the preceding genus, and the whole cheek is covered by an osseous plate, shagreened in a similar manner to those on the rest of the head. Around each jaw there is a row of conical teeth, and behind some close or rasp-like teeth. Their stomach is capacious, the intestine narrow, with a spiral valve and one cæcum. The swimming bladder is double, with large lobes, particularly that on the left side, communicating by a wide aperture with the œsophagus.

Polyp. bichir (*P. Niloticus*, Shaw) may be named as a species of the genus. It has sixteen dorsal fins, and was discovered by M. Geoffroy in the Nile. (See Plate CCCV. fig. 3.) *Polyp. Senegalus*, Cuv. is another species from Senegal. It has only twelve dorsal fins. The flesh of these fish is good eating.

ORDER III.—MALACOPTERYGII SUB-BRACHIATI.

This order is characterised by the attachment of the ventral fins beneath the pectorals,—which latter may be regarded as analogous to the arms, and hence the name *Sub-brachian*. The pelvis is suspended immediately from the bones of the shoulder.

This order contains as many families as Linnæan genera.

FAMILY I.—GADIDÆ.

Comprehends the members of the great Linnæan genus *GADUS*, containing the well-known cod and haddock.

The Gadi in general are recognised by the ventral fins being pointed and attached to the throat. The body is moderately elongated, slightly compressed, and covered with soft and not very large scales. The head is well proportioned, and without scales; all the fins are soft. The jaws, and the front of the vomer, are armed with several rows of pointed, irregular, middle-sized, or small

teeth, forming a sort of currycomb or rasp. Their gill-covers are large, with seven rays. Most of the species have two or three fins on the back, one or two behind the anus, and a distinct caudal. Their stomach forms a large muscular sac; the cæca are very numerous. The swimming bladder is large, and has strong parietes, frequently dentated on the sides.

These fishes generally live in cold or temperate climates, and constitute a very important article of fishery. The greater number are considered wholesome, and form a light and agreeable food,—the flesh separating easily by boiling, into white flaky layers. The great sand bank of Newfoundland is the most famous station of the cod fisheries, and is resorted to by English fishermen, who chiefly use the hook and line. The fish abound in this place probably on account of the great quantity of the smaller animals which serve as food, viz. mussels, clams, &c.

The family of *GADIDÆ* has been divided by Cuvier into *MORRHUA*, or cods properly so called, *MERLANGUS* or whittings, *MERLUCCius* or hakes, *LOTA* or lings, *MOTELLA*, *BROSMIUS*, *BROTULA*, *PHYCIS*, and *RANICEPS*.

GENUS MORRHUA, Cuv. Has three dorsal fins and two anal; a tuft at the point of the lower jaw. The species are extremely prolific.

M. vulgaris (*Gadus morrhua*, L.). The common cod (*la Morue*, Fr.; *Kabliau*, Germ.) measures from two to three feet in length. The back is spotted with yellowish brown. It inhabits the whole Northern Ocean, and occurs in vast profusion.

This fish dwells in salt water only. It is not found nearer the equator than the 40th degree of latitude. The weight of the common cod varies from twelve to eighty or even 100 pounds. It is extremely voracious, and its digestive powers are seemingly very great. It feeds upon smaller fishes, such as herrings, on Mollusca, worms, and Crustacea, and even on the young of its own species. It has a strong muscular stomach, and is said to possess the power of rejecting by the mouth substances, such as wood, &c. which it finds indigestible.

In spring they come nearer the shore in order to deposit their spawn. This happens in January in England, in February in Norway, Denmark, and Scotland, and in March in Newfoundland. One female is said to contain from four to nine millions of eggs!

The most extensive cod fisheries on our coasts are off the Western and Shetland Isles, but they are still greater in more northern countries. The cod has been fished on the coast of Sweden since the year 1368, by the inhabitants of Amsterdam. The English resorted to Iceland before the year 1415; and it is stated that in the year 1792, 200 French vessels of a burden of 191,153 tons were employed in the cod fishery. Every year more than 6000 European vessels are employed in this fishery.¹

The flesh of the cod has a good flavour, and may be easily preserved. The tongue, salted and dried, has been considered a great delicacy. The gills are preserved and used as bait. The liver is eaten, and is sometimes used for the production of oil. The swimming bladder affords a very good isinglass.

This important species constitutes a principal article of food to the inhabitants in some parts of Iceland, Norway, and other northern countries. In a dried state it is also much used in some papal kingdoms of the south.

In the neighbourhood of the Isle of Man, and elsewhere, there is a variety of the cod named the red or rock cod, the skin of which is of a brightish vermillion colour. Its flesh is much esteemed.

¹ We cannot in this place enter upon the important subject of *Fisheries*; but the reader may consult with advantage Pennant's *British Zoology*, vol. iii. and Dubamel's *Traité Général des Pêches*.
VOL. XII.

Malacop-
terygii
Sub-bra-
chiati.
Gadidæ.

M. æglefinus (*Gadus æglefinus*, Linn.). The haddock (*Pegrefin*, Fr.; *Schollfisch*, Germ.) is as well known, and almost as important, as the cod in this country; it is of a smaller size, usually eighteen inches long. The back is brown, the belly silvery, and the lateral line black. There is a blackish spot behind the pectoral fin, which tradition assigns to the impression of St Peter's finger and thumb when he took the tribute-money out of the mouth of a fish, supposed the haddock. The upper jaw is longest.

The haddock is found, like the cod, in the Northern Ocean, but has not been seen in the Baltic. It annually approaches the shores, in February and March generally, in order to deposit its spawn. The regularity with which it re-appears in some districts on a stated day is quite remarkable. On the coast of Yorkshire, since the year 1766, they have annually made their appearance on the 10th of December. At this place they are supposed to form an immense shoal three miles broad, and extending eighty miles in length,—from Flamborough Head to the mouth of the Tyne. It is in autumn that they visit the shores of Holland and East Friesland, and the neighbourhood of Heligoland.

The haddock frequents our coasts during the greater part of the year, although the largest are taken in winter. The flesh is generally best in the months of May and June.

It is stated, that in the north, when the sea is frozen near the shore, these fish collect in troops beneath any openings in the ice, and the Greenlanders are thus enabled to catch them in considerable numbers. The seals and foxes adopt the same method of securing them for food. The food of the haddock is very similar to that of the cod, which species it resembles in its voracious habits.

M. callarias (*Gadus callarias*, Linn.). The dorse (*Faux Merlan*, Fr.) is smaller than the haddock, being only eleven or twelve inches long. It is spotted like the cod, and has the upper jaw longer than the under. The lateral line is placed near the back. It resembles the whiting in taste, and is considered by many as the best eating fish of all the *Gadus* tribe. It is much sought after on the shores of the Baltic.

This fish frequents the mouths of large rivers, which it sometimes ascends along with the salt water. It is generally taken in June. The Icelanders salt and dry it, and the Greenlanders are said frequently to eat it in a state of semi-putrefaction.

To these fishes, which are among the best-determined species of the old genus *Gadus*, may be added *Gadus barbatus* or whiting pout, a fish about eighteen inches or two feet long, which is eaten by the Greenlanders, but not much esteemed. *Gadus minutus*, the capelan or poor, *Gadus punctatus*, the speckled cod, and *Gadus luscus*, the bib, may be named as other species which occur along the British shores.

GENUS MERLANGUS, Cuv. The whittings have the same number of fins as the cods, but they want the barbels.

M. vulgaris (*Gadus merlangus*, Linn.). The whiting, *Merlan*, Fr.; *Witling*, Germ. The body a foot or more in length; upper jaw long; pale reddish-gray back, and silvery belly; lateral line yellow, nearly straight.

This fish is very common on our coasts, and is valued on account of its abundance, and the wholesomeness and fine flavour of its flesh. It is often salted and dried in this country, as well as in Holland. The shoals of whittings sometimes occupy a space three miles long, and one and a half broad. It is generally fished in summer in this country, and is taken both with the line and net. The food of the whiting is similar to that of the haddock. It is more frequently found near the shore than that species.

M. carbonarius (*Gadus carbonarius*, L.). The coal-fish (*Merlan noir ou Colin*, Fr.; *Kohlfisch*, Germ.) is twice the size of the whiting, and of a deep brown colour; the upper

jaw shortest; the lateral line straight and white. The flesh of the young is rather delicate; that of the adult is somewhat leathery, but it is used when salted and dried, like the cod. This is the *podley*, *sillock*, *cuddy*, &c. of our coasts. The young swarm along the British shores, and form a frequent sustenance of the lower orders of the Western Highlands. On one occasion we killed thirty-three dozen with the rod in a few hours, using a line with six small flies. By giving the line one or two additional turns through the water, we frequently pulled six ashore at once. It even constitutes an important article of exportation from our northern coasts. In Norway the poor feed upon it; and oil is made from its liver. The adult fish is taken principally in summer; it deposits its spawn in this country in February and March. The coal-fish is found in the North Atlantic and Pacific Oceans; and sometimes, though very rarely, in the Mediterranean Sea,—for example, near Nice.

M. pollachius (*Gadus pollachius*, L.). The pollock or pollack, *Merlan jaune*, Fr. About eighteen inches long; resembles *M. carbonarius* in its general form and structure of the jaws; brown above and silvery beneath; sides spotted; lateral line curved, black. The flesh of the pollock is considered better than that of the coal-fish, and inferior only to that of the dorse and whiting; it inhabits the Atlantic, and is gregarious. It is commonest on the coasts of Norway and the north of England, and sometimes occurs in the Mediterranean in winter. It is easily caught with a white fly.

Gadus virens, Ascan., the sey, may also be included in the genus *Merlangus*.

GENUS MERLUCCIUS, Cuv. The hakes have only two dorsal fins and one anal, and resemble the whittings in the absence of the barbels.

M. vulgaris (*Gadus merluccius*, L.). The hake (*le Merlus*, Fr.) is generally from one to two feet long, but sometimes much larger. The back of a brownish-gray colour; the anterior dorsal fin pointed; the lower jaw longest.

Great numbers are taken in the ocean, and in the Mediterranean. On the coasts of the Mediterranean it is called merlan or whiting; and, when dried, it receives in the north the name of stock-fish, in the same way as the cod. It is said to be very abundant in the Bay of Galway on the west of Ireland, and at Penzance in Cornwall. The flesh is white and flaky, and its liver is considered a delicacy.

Gadus magellanicus, Forst., and *Gadus maraldi*, Risso, may be included in this group.

GENUS LOTA, Cuv. The *lings* have the same fins as the hakes, but are also provided with barbels to a greater or less amount.

Lota molva (*Gadus molva*, L.) or common ling (*la Lingue*, or *Morue longue*, Fr.), is the best-known species. It measures from three to four feet in length, and sometimes even attains the size of seven feet; it is named ling from its lengthened shape. Olive above, silvery beneath. The fins have a white margin; the two dorsal fins are of equal height. The lower jaw rather the shortest, and furnished with a single barbel.

This fish spawns in June; it inhabits the same seas as the cod, and is fished in the same manner during the spring months. It is preserved dry, and exported in considerable quantity.

Lota fluviatilis (*Gadus lota*, L.), river ling or burbot (*la Lotte commune*, Fr.), is from one to two feet long. Its colour yellow, marbled with brown; a single barbel on the chin. The two dorsal fins are of equal height, the second extending to near the tail. The body is almost cylindrical, and the head slightly depressed, so as to give the fish a peculiar appearance, somewhat resembling that of an eel; hence its occasional name of Eel Pout. See Plate CCCV. fig. 5.

Malacop-
terygii
Sub-bra-
chiati.
Gadidæ.

Malacop-
terygii
Sub-bra-
chiati.
Gadidae.

This is the only *Gadus* which inhabits fresh water; it ascends rivers to a considerable distance, and inhabits lakes. It is very abundant in North Asia and the Indies. It is also well known in North America. In England it is found only in a few rivers. The flesh and liver of the burbot are esteemed.¹

To this sub-genus may be added *Gadus Bacchus*, Forst., *Gadus maculosus*, Lesueur, and *Lota clongata*, Risso.

Among the lings, Cuvier has distinguished another small group named

GENUS MOTELLA, Cuv., in which the anterior dorsal fin is so small as scarcely to be perceptible.

As species we may name *Gadus mustela*, L. described by Bloch as *G. tricirrhatus*. It is of a fawn-coloured brown, with blackish spots; two barbels on the upper jaw, and a third on the lower one. *Gadus cimbricus*, Schn. (*G. quinquecirrhatus*, Penn.) is also a *Motella*. The species are called *Gades* by English writers.

GENUS BROSMIUS, Cuv. The *torsks* or *tusks* have only one dorsal fin, which extends nearly the whole length from the head to the tail.

B. brosme, or Scotch torsk, seldom ventures farther south than the Orkneys or Caithness; it is very numerous near the Shetland Isles. It is called *Brosme* by the fishermen, from its resemblance to the blenny genus. The name of torsk is applied in Norway and Sweden to the *Gadus callarias* (a true *Morrhua*), which has three dorsal fins. This circumstance has given rise to some confusion. Donovan described the Scotch torsk from a specimen sent him alive from Shetland. It is salted and dried in the north.

GENUS BROTULA, Cuv. Dorsal and anal fins united with the caudal, so as to form a single fin, terminating in a point.

One species only (*Euchelyopus barbatus* of Bloch and Schneider) is known. It has six barbels, and comes from the Antilles.

GENUS PHYCIS, Art. and Schn. Differs from the other Gadi in having ventral fins with only one ray,—frequently forked. The head is thick, the chin with one barbel. Two dorsal fins, the second of which is long. Some species are found in European seas.

Such is *Phycis Mediterraneus*, Laroche, sometimes called the sea tench (*Blennius phycis*, Linn.). Anterior dorsal round, and not higher than the other; the ventrals of the same length as the head. This is a common species in the Mediterranean.

Phycis blennoides, Schn., *S. furcatus*, or forked hake of Pennant, occurs also in the ocean. The first dorsal fin is more elevated, and its first ray considerably elongated; the ventral fins are twice the length of the head. It is a British species, though a rare one.

GENUS RANICEPS, Cuv. The head more depressed than in *Phycis* and the other Gadi; the anterior dorsal fin so small that it is lost in the thickness of the skin. Inhabits the ocean.

The trifurcated hake of Pennant belongs to this genus.

GENUS MACROURUS, Bl. *Lepidoleprus*, Risso. The sub-orbitals unite in front with each other and with the bones of the nose, so as to form a depressed snout, which projects above the mouth, and beneath which the latter preserves its mobility. The head and body are covered with hard and spiny scales. The ventral fins are small and somewhat jugular; the pectorals of moderate size; the

first dorsal short and high; the second dorsal and anal both very long, and uniting with the caudal; very fine short teeth in the jaws.

The species inhabit deep water, and when taken from it utter sounds resembling those of the genus *Gristes*. Only two species have been as yet described, the *Lep. caloryhynchus* and *trachyrhynchus* of Risso. They occur both in the Mediterranean and along the oceanic coasts of France.

Malacop-
terygii
Sub-bra-
chiati.
Pleuronec-
tidae.

FAMILY II.—PLEURONECTIDÆ.

This family of the sub-brachian malacopterygian order comprehends the great Linnean genus *PLEURONECTES*, which includes all those osseous species usually known under the name of *flat fish*.

They are at once distinguished by a character unique among vertebrated animals, viz. the want of symmetry in the construction of the head; both eyes being placed on the same side, or on that which remains uppermost when the animal swims, and which is always of a darker colour; while the side in which the eyes are wanting faces the ground, and is always whitish, or very pale. Some of the other organs participate in this irregularity of the orbits; thus the two sides of the mouth are unequal, and the two pectoral fins are generally of different sizes. Their body is much compressed, and raised vertically. The dorsal fin runs along the whole of the back, the anal occupies what may be regarded as the under part of the body, and the ventrals have almost the appearance of continuing that fin forwards, so much do they often appear as if united together. There are six rays in the branchiostegous membrane. The abdominal cavity is small (the anus being far forwards); but it is prolonged into a sinus in the thickness of the two sides of the tail, in which some portion of the viscera is lodged. There is no swimming bladder, and these fishes seldom quit the bottom.

The *PLEURONECTIDÆ* furnish an agreeable and wholesome food, and occur along the coasts of almost all countries. The disposition of the bones of the head is curious, on account of the inversion which brings the two orbits to the same side; still we recognise in it all the pieces common to the other genera, but of unequal size. Individuals termed *reversed* are sometimes found, having the eyes placed on a different side from that on which they are situated in the rest of their species. Others, having the two sides of the body of the same colour, are called *double*. The brown or upper side is more frequently thus repeated than the white one; but the *rose-coloured flounder* of Shaw presents an instance of the duplication of the paler side.²

The genus *Pleuronectes* was formerly subdivided according as the eyes were placed on the right or left side of the middle line; but, on account of the irregularity of individuals in this respect, Cuvier has rejected the character, and has distinguished various groups, as follows:

GENUS PLATESSA, Cuv. Has on each jaw a range of obtuse cutting teeth, and generally some teeth in the form of pavement (*en pavés*) on the pharyngeal bones. The dorsal fin advances forwards as far as the upper eye, and leaves, as well as the anal, a naked interval between it and the caudal. The form of the body is rhomboidal; the majority have the eyes on the right side. They have two or three small cæca. Several inhabit the British seas.

¹ "On estime fort sa chair, et surtout son foie, qui est singulièrement volumineux," observes Baron Cuvier, *Règne Animal*, t. ii. p. 334. A different opinion, however, has been formed of it in the western world. "The burbot," says Dr Richardson, "is so little esteemed as food, as to be eaten only in cases of necessity. Very good bread, however, may be made of the roe, and the livers are always prized. Dogs will scarcely ever eat this fish." (*Appendix to Captain Franklin's first Journey to the Polar Sea*, p. 724.) Dr R. adds, that this species preys upon every kind of fish that it can swallow, and that in spring its stomach is generally so crammed with cray-fish as to distort the shape of the body.

² *Gen. Zool.* vol. iv. part 2, pl. xliii.

Malacop-
terygii
Sub-bra-
chiati.
Pleuronec-
tidæ.

P. vulgaris (*Pleuronectes platessa*, L.). The plaice (*Carelet*, Fr.; *Scholle*, Germ.) is recognised by six or seven tubercles forming a line on the right side of the head between the eyes, and by spots of a bright yellow colour, which relieve the brown of the body on that same side. This fish is three times as long as it is high. Plate CCCV. fig. 6.

The plaice grows sometimes to the size of fifteen or sixteen pounds weight, but those weighing seven or eight pounds are considered large; its flesh is more tender than that of any other species of the genus. It inhabits the Mediterranean, Baltic, and North Seas, and spawns in spring.

A large plaice, *Pl. borealis*, Fabr., having the spine behind the anus concealed under the skin, is described as belonging to the northern regions.¹

Pl. latus, Cuv. The broad plaice (*la Plie large*, Fr.) is a much rarer species. It has the same tubercles as the common plaice, and differs from it chiefly in being only once and a half as long as it is high.

Pl. flesus, L. The flounder (*le Flet ou Picaud*, Fr.; *der Flûnder*, Germ.) has nearly the same form as the plaice, with paler spots; it has only small granular eminences at the salient line of the head, and at the base of each ray of the dorsal and anal fins there is a small rough projection; the lateral line has also bristly scales. Many of this species occur reversed.

The flounder is taken in spring near the shore, and at the mouths of rivers, into which it sometimes ascends a considerable way; it lives well in fresh water, and is kept in ponds in Friesland. It inhabits the Baltic and North Atlantic Seas. Its flesh is much inferior to that of the plaice; the best are said to be taken near Memel.

Pl. pola, Cuv., is a fish described by Duhamel under the name of *La Vraie Limandelle*. It is of an oblong form, approaching to that of the sole, although broader. It is distinguished from other *Platessæ* with sharp teeth, by a smaller head and mouth. The body is smooth and the lateral line straight. In France it is considered as equal to the sole.

Pl. limanda, L. The dab or bret (*la Limande*, Fr.; *die Glahrke*, Germ.) is of a rhomboidal form, like the flounder; has large eyes, and a salient line between them. Its lateral line is strongly curved above the pectoral fin. Its scales are rougher than in the preceding species, and to this character it owes its name (from *lima*, file). Its teeth, though in a single row, as in other *Platessæ*, are narrower, and almost linear. The side on which the eyes are placed is of a clear brown, with some indistinct brown and whitish spots. This is a small fish, its length being less than a foot; but it is much esteemed. It is less common than either the plaice or flounder. It spawns in May, and is in season for the table during spring.

GENUS HIPPOGLOSSUS, Cuv. Has a form of body, and fins, similar to the plaices; the jaws and pharynx are armed with sharper and stronger teeth. Their form is generally more oblong.

H. vulgaris (*Pl. hippoglossus*, L.). The great holibut, or halibut (*le grand Flétan ou Helbut*, Fr.; *die Heiligbutte*, Germ.), is one of the largest of this genus inhabiting the northern seas. It sometimes attains a very great size, for example, to the length of six or seven feet, and weighing three or four hundred pounds. The skin is smooth; it has the eyes to the right side; the lateral line arched above the pectoral fin; there is a long spine before the anal fin.

This is the most voracious of all the Pleuronectidæ,

preying on smaller fishes, Crustacea, Mollusca, &c. It inhabits the Mediterranean, as well as the northern seas. The flesh of the young is esteemed, and is not seldom sold to the uninitiated for turbot, to which, however, it is much inferior in every way. Indeed, when old, it is extremely coarse.²

In the Mediterranean there are several smaller species, of which some have the eyes to the left side. Such is *Pl. macrolepidotus*, Bl.—*Citharus*, Rond.; distinguished by the large size of its scales, its oblong form, and straight lateral line. (Plate CCCV. fig. 7.) *Pl. cynoglossus* is described by Shaw as a smaller holibut, found in considerable quantity in Greenland, and superior to the common kind as an article of food.

GENUS RHOMBUS, Cuv. The turbot, like the holibuts, have teeth closely set, or *en carde*, both on the jaws and pharynx; but their dorsal fin advances as far as the edge of the upper jaw, and extends, in common with the anal, to near the caudal fin. The greater number have the eyes to the left.

In some the eyes are approximate, and in the interval between them there is a slight projecting crest. The two largest of our coasts are of this kind; they are the most esteemed as food of all the PLEURONECTIDÆ.

Rh. maximus (*Pl. maximus*, L.). The turbot, *le Turbot*, Fr.; *Steinbutte*, Germ. This fish, so highly prized on account of its delicate flavour, and the wholesomeness of its flesh, is distinguished by the rhomboidal shape of its body, which is nearly as high as it is long. It is bristled on the brown side with small tubercles; has the lateral line curved; and the eyes on the left side.

This species is usually much smaller than the holibut; it is frequently two feet long, with a weight of twenty pounds; but it is stated sometimes to attain the length of five or six feet. Extensive turbot fisheries are established on different parts of our coast. The turbot is taken with the hook; it is very voracious, and may be lured by various baits, such as portions of herring or haddock, mussels, limpets, and other shell-fish; but all these must be very fresh. Indeed the species very sensibly prefers live bait without hooks, more especially the small river-lamprey. Mr Pennant has particularly described the extensive turbot fishery at Scarborough. There are three men in each of the fishing-boats, each man having three lines, and each line 280 hooks. All the nine lines are fastened together, and then extend to about three miles in length; they are laid across the current, and are allowed to remain for six hours before they are hauled. This fish is called the water or sea-pheasant, by the French common people, on account of its fine flavour.

Rh. rhombus. The pearl or brill, *la Barbuë*, Fr. The body more oval than that of the turbot; without tubercles; and distinguished besides by the first rays of its dorsal fin being half free, with their extremities divided into several strips. This fish is of a smaller size than the turbot; it has a delicate flavour, and is in great request.

Rh. punctatus; *Pl. levis*, Shaw. The kitt (*le Targuer*, Fr.) is much rarer than the preceding on our coasts. Its shape is oval like the brill; it has no strips on the rays of its fins; its scales are rough; its teeth very fine; its cheek furnished with very close and even teeth; and it has black points and spots on a brown ground. It is said to be more frequent in Shetland than along the other British coasts.

Rh. cardina. The whiff (*la Cardine*, or *Calimande*, Fr.) is quite of an oblong form; its first rays are free, but simple;

Malacop-
terygii
Sub-bra-
chiati.
Pleuronec-
tidæ.

¹ *Isis*, xxi. p. 863.

² Nevertheless it is generally called *turbot* in the Edinburgh market, where the true turbot passes under the classical cognomen of *raun-fleut*.

Malacop- its teeth very close and even. It has spots partly white
terygii and partly blackish, scattered on a brown ground. This
Sub-bra- species is taken, though seldom, in the Channel.
chiati.
Discoboli.

In the Mediterranean there is a small species, only a few inches long,—*Pl. nudus*, Risso; *Arnoglossum*, Rond.; and another still smaller, which is quite transparent,—*Pl. candidissimus*, Risso; *Pl. diaphanus*, Schn.

In other turbots the eyes are distant, the upper one far back; their interval is concave; they have a small projecting hook on the base of the maxillary bone at the side on which the eyes are placed, and sometimes another on the inferior eye. There are several of this nature in the Mediterranean, such as the *Pl. podas* of Laroche.¹ We have figured *Pl. argus* on Plate CCCV. fig. 8.

GENUS SOLEA, Cuv. The soles have, as a distinguishing character, the mouth twisted to the side opposite the eyes; that side only being furnished with teeth, which are fine, like the pile of velvet, or, according to Cuvier's frequent expression, *en velours*; the side on which the eyes are placed is toothless. Their form is oblong; the snout round, and almost always projecting more than the mouth. The dorsal fin commences at the mouth, and extends, as well as the anal, to the caudal fin. The lateral line is straight; the side of the head opposite to the eyes is furnished with a kind of villosity. The intestine is long; it forms several folds, but has no cæca.

S. vulgaris (*Pl. solea*, L.). The sole (*le Sole*, Fr.) is a species common on the European coasts, and universally esteemed wherever known. Brown on the side which bears the eyes; the pectoral fin spotted with black. It is one of our most valued fishes for the table, the flesh being firm, white, and of delicious flavour. The sole generally measures from one to two feet in length, and its weight varies from one to seven pounds. It is a gregarious fish, and is generally taken with the trawl-net. It inhabits the Baltic, North, Atlantic, and Mediterranean Seas. There is a large sole fishery at Brixham in Torbay, and a very extensive one on the coast of Sardinia. The best soles are said to be found at the Cape of Good Hope; yet our honoured friend Justice Menzies does not esteem them so highly as he did those of his native Scotland.

There are many distinct species of this genus, besides numerous varieties that have been too vaguely described to admit of their being easily distinguished from each other. We shall here merely name the *Pallasian*, *Zebra* (Plate CCCV. fig. 9), *Carolina*, *Ocellated*, *Rondeletian*, *Platessoid*, *Silver*, *Smooth*, *Bearded*, *Marbled*, *Pavonian*, and *Variegated* Soles.

GENUS MONOCHIRUS, Cuv. Contains such soles as have only a very small pectoral fin on the side of the eyes, the one on the opposite side being either very minute, or wholly wanting. There is one Mediterranean species, the *Pl. microchirus* of Laroche.²

GENUS ACHIRUS, Lacép. Contains the species which are wholly destitute of pectoral fins; and which may again be divided according as their vertical fins are distinct, as in *Achiri* properly so called, or united to the caudal fin, as in the sub-genus *Plagusia*.

FAMILY III.—DISCOBOLI.

Forms the concluding division of the sub-brachian malacopterygian fishes. They receive their name from the disk formed by their ventral fins. This family comprehends two genera, neither of which is numerous.

GENUS LEPADOGASTER, Gouan. The ample pectoral fins

descend to the inferior surface of the body, and become united together beneath the throat by a transverse membrane, directed forwards, which is formed by the union of the two ventral fins. The body is smooth and without scales; the head broad and depressed; the muzzle projecting and extensile; the branchial openings small; the gill-covering furnished with four or five rays. There is only one soft dorsal fin, opposite to an anal of a similar kind. The intestine is short, straight, and without cæca. There is no swimming bladder, but nevertheless the species swim rapidly along the shores. The genus is divisible as follows:

1st, LEPADOGASTER properly so called. The membrane already mentioned, which takes the place of the ventral fins, extends circularly under the pelvis, and forms a concave disk; on the other hand, the bones of the shoulder form a slight projection behind, which completes a second disk with the membrane uniting the pectorals.

Several species inhabit the Mediterranean and neighbouring seas. In some the dorsal and anal fins are distinct from the caudal, with which their membrane is however sometimes continuous, though it at the same time becomes narrower. Of this kind are the *Lep. Gouani*, *balbis*, and *Decandolii*. In others, these three fins are united, as in *L. Willdenovii*. The *Cyclopterus cornubicus* of Shaw (*Jura sucker* of Pennant) belongs to the genus Lepadogaster.

2d, GOBIESOX, Lacép. Interval between the pectoral and ventral fins not divided into a double disk, but forming only a large single disk, cleft on both sides, and prolonged by the membranes. The dorsal and anal fins are short, and distinct from the caudal. The branchial apertures are larger than in the preceding. A British species, known under the name of bimaculated sucker (*Cyc. bimaculatus*, Pennant), belongs to this genus. It is a very small fish, not measuring more than an inch and a half. Montagu found it adhering to stones and old shells, and obtained it in abundance, by dredging, near Forcross.³

GENUS CYCLOPTERUS, Linn. The circle-finned fishes, commonly called *suckers* or *lump-fish*, have a well-marked character in their ventral fins, the rays of which, suspended all round the pelvis, and united by a single membrane, form an oval and concave disk, which the fish employs as a sucker to fix itself to the rocks. Besides this, their mouth is wide, and furnished on both jaws and pharyngeal bones with small pointed teeth. Their opercles are small; their branchial openings closed towards the bottom, and furnished with six rays. Their pectoral fins are very large, and unite almost under the throat, embracing as it were the disk of the ventrals. Their skeleton does not harden much; and their skin, viscous and without scales, has small hard grains scattered here and there upon its surface. They have a stomach of considerable size, many cæca, a long intestine, and a swimming bladder of ordinary dimensions.

The Cyclopteri are divided by Cuvier into two sub-genera, as follows:

1st, LUMPUS. Has a first dorsal fin, more or less perceptible, though very low, and with simple rays,—and a second one with branched rays opposite to the anal. The body is thick.

Cycl. lumpus, L. (Plate CCCV. fig. 11.) The lump-fish or sucker (*le Lump*, *Gras Mollet*, Fr.; *See Hase*, Germ.) has its first dorsal fin so much enveloped in a thick tubercular skin, that externally it might be taken for a mere hump on the back. It is furnished with three rows of conical tubercles on each side.

This fish is about eighteen inches long. It lives, especially in the north, on Medusæ and other gelatinous animals. Its flesh is soft, insipid, somewhat oily, and is sel-

Malacop-
terygii
Sub-bra-
chiati.
Discoboli.

¹ *Ann. du Mus.* xlii. xxiv. 14.

² *Ibid.* xlii. 356.

Linn. Trans. vol. vii. p. 293.

Malacop-
terygii
Sub-brach-
chiati.
Discoboli.

dom used for food by those who can provide better. It is, however, held in some estimation by the Greenlanders, themselves an oily people, whose lines do not always fall in pleasant places. They also eat its roe (which is a very large one), after having reduced it by boiling to a pulp. In Ireland it is sometimes salted. This fish is very unwieldy, and, possessing few means of defence, it generally remains at the bottom of the sea, adhering to the rocks. It thus becomes an easy prey both to seals and sharks. Large placid oily spots upon the surface of the sea are often seen above the places where the lump-fish have been seized and slain. We also occasionally find their skins floating empty along the shore, the flesh and blood having been previously extracted by their insatiate foes. The male is said to preserve with great care the eggs which he has fecundated, and he has moreover been famed in fable for his affectionate behaviour to the female. There does not, however, appear to be any real foundation for this trait in his character,—a very unfrequent one in that of any member of the fishy tribes.

Cyclopt. spinosus inhabits the northern seas. *Cycl. minutus* is found in the Atlantic, and *C. nudus* in the Indian Ocean.

2d, *LIPARIS*, Artedi. Has only one dorsal fin, which, as well as the anal, is rather long. The body is smooth, elongated, and compressed behind.

Lip. vulgaris (*Cyc. liparis*, L.), the unctuous sucker of Pennant, is a European species of variable size, not uncommon about the mouths of rivers, especially those of the northern seas. It is a well-known British species, remarkable not merely for dying, but for actually *dissolving*, soon after it is taken out of the water. *Liparis Montagu* measures only about two inches in length.¹ It was discovered by the naturalist whose name it bears, among the rocks at Milton, on the south coast of Devon, during some extraordinary low tides. *Lip. gelatinosus* is another northern species, the flesh of which is not eatable, as described by Pallas in his *Spicilegia Zoologica*. Its flesh is so bad that not even dogs will eat it.

GENUS *ECHENEIS*, Linn. This genus, so different from its neighbours, might, like the old Linnæan genus *Pleuronectes*, almost form a separate family of the sub-brachian malacopterygian fishes. The species called *Remoras* are remarkable for the flattened disk they bear upon their heads, and by means of which they can adhere to other bodies with considerable firmness. These disks are composed of a certain number of transverse cartilaginous plates, directed obliquely backwards; dentated or spinous at their posterior edge, and moveable in such a manner that the fish can create a vacancy between them; and thus, aided also by the toothed margin, it fixes itself securely either to rocks or floating bodies.

This genus has the body elongated, and clothed with small scales; a single soft dorsal fin opposite to the anal; the head quite flat above; the mouth cleft horizontally, and rounded; the lower jaw placed more forwards, and furnished, as well as the inter-maxillary bones, with small pectiniform teeth. There is a row of regularly-set small teeth, like cilia, along the edge of the maxillaries, which form the external margin of the upper jaw; the vomer is furnished with cardiform teeth, as well as the tongue. They have eight branchiostegous rays. Their stomach is a wide cul-de-sac; the cæca six or eight in number; the intestine wide, but short. They have no swimming bladder.

The species are few in number. Of these, *Echeneis remora*, Linn., the famous *Remora*, or sucking fish, of the Mediterranean, is the best known. It has usually eighteen plates in its cranial disk.

The extraordinary power possessed by this fish, of adhering tenaciously to any flattish surface, was known to ancient writers, as well as to the curious inquirers of modern times. Pliny luxuriates upon it with his usual discursive verbosity. The reader may possibly be amused by Philemon Holland's translation of the passages in question. "Having so far proceeded in the discourse of nature's historie, that I am now arrived at the very heighth of her forces, and come into a world of examples, I cannot chuse but in the first place consider the power of her operations, and the infinitesse of her secrets, which offer themselves before our eyes in the sea: for in no part else of this universal frame is it possible to observe the like majestie of nature: insomuch, as we need not seeke any farther, nay, we ought not to make more search into her divinitie, considering there cannot be found any thing equall or like unto this one element, wherein she hath surmounted and gone beyond her own selfe in a wonderfull number of respects. For, first and foremost, is there any thing more violent than the sea; and namely when it is troubled with blustering winds, whilepuffs, storms, and tempests? or wherein hath the wit of man been more employed (seeke out all parts of the known world) than in seconding the waves and billows of the sea, by saile and ore? Finally, is there ought more admirable than the inerrable force of the reciprocall tides of the sea, ebbing and flowing as it doth, whereby it keepeth a current also, as it were the stream of some great river?"

"The current of the sea is great, the tide much, the winds vehement and forcible; and more than that, ores and sailes withall to help forward the rest, are mightie and powerfull: and yet there is one little sillie fish, named echencis, that checketh, scorneth, and arresteth them all. Let the winds blow as much as they will, rage the storms and tempests what they can, yet this little fish commaundeth their furie, restraineth their puissance, and, maugre all their force, as great as it is, compelleth ships to stand still: a thing which no cables, be they never so big and able as they will, can perform. She bridleth the violence and tameth the greatest rage of this universall world, and that without any paine that she putteth herselfe unto, without any holding or putting backe, or any other meanes save only by cleaving and sticking fast to a vessell: in such a sort as this one small and poore fish is sufficient to resist and withstand so great a power both of sea and navie, yea and to stop the passage of a ship, doe they all what they can possible to the contrarie. What should our fleets and armadoes at sea make such turrets in their decks and forecastles? what should they fortifie their ships in warlike manner, to fight from them upon the sea, as it were from mure and rampier on firme land? See the vanitie of man! alas, how foolish are we to make all this adoe? When one little fish, not above half a foot long, is able to arrest and stay per force, yea, and hold as prisoners, our goodly tall and proud ships, so well armed in the beakehead with yron pikes and brazen tines; so offensive and dangerous to bouge and pierce any enemy ship which they doe encountre. Certes, reported it is, that in the naval battaile before Actium, wherein *Antonius*, and *Cleopatra* the queene, were defeated by *Augustus*, one of these fishes staid the admirall ship wherein *M. Antonius* was, at what time as he made all the hast and meanes he could devise with help of ores to encourage his people from ship to ship, and could not prevaile, untill he was forced to abandon the said admirall, and go into another galley. Meanwhile the armada of *Augustus Cæsar*, seeing this disorder, charged with greater violence, and soone invested the flecte of *Antonie*. Of late daies also, and within our remembrance, the like

Malacop-
terygii
Sub-brach-
chiati.
Discoboli.

¹ Donovan's *British Fishes*, t. lxviii.

Malacop-
terygii
Sub-bra-
chiati.
Discoboli.

happened to the roiall ship of the emperor *Caius Caligula*, at what time as he rowed backe, and made saile from Astura to Antium; when and where this little fish detained his ship, and (as it fell out afterward) presaged an unfortunate event thereby: for this was the last time that ever this emperor made his returne to Rome: and no sooner was he arrived, but his own souldiours in a mutinie fell upon him and stabbed him to death. And yet it was not long ere the cause of this wonderfull staie of his ship was knowne: for so soon as ever the vessel (and a galliace it was, furnished with five bankes of ores to a side) was perceived alone in the flecte to stand still, presentlie a number of tall fellows leapt out of their ships into the sea, to search what the reason might be that it stirred not; and found one of these fishes sticking fast to the very helme: which being reported unto *Caius Caligula*, he fumed and fared as an emperor, taking great indignation that so small a thing as it should hold him back perforce, and check the strength of all his mariners, notwithstanding there were no fewer than foure hundred lustie men in his galley that laboured at the ore all that ever they could to the contrarie. But this prince (as it is for certain knowne) was most astonied at this, namely, that the fish sticking only to the ship, should hold it fast; and the same being brought into the ship and there laid, not worke the like effect. They who at that time and afterward saw the fish, report that it resembled for all the world a snail of the greatest making: but as touching the form and sundrie kinds thereof, many have written diversly, whose opinions I have set downe in my treatise of living creatures belonging to the waters, and namely in the particular discourse of this fish: neither doe I doubt but all the sorte of fishes are able to doe as much: for this we are to believe, that Pourcellans also be of the same vertue, since it was well knowne by a notorious example, that one of them did the like by a ship sent from *Periander* to the Cape of Gnidus: in regard whereof, the inhabitants of Gnidus doe honour and consecrat the said Porcellane within their temples of *Venus*. Some of our Latin writers do call the said fish that thus staith a ship, by the name of *Remora*."

Another species, *Echeneis Naucrates*, Linn. (Plate CCCV. fig. 10), commonly called the Indian Remora, has usually twenty-two plates upon the head. In its habits it resembles the preceding; but it seems to be more frequent in the seas of India and America, than in those of Europe. The manuscripts of Commerson, as quoted by Count Lacépède, inform us that it is common along the coasts of Mosambique, where it is made use of in a singular way for the purpose of catching turtles. A ring is first fastened round its tail, and then a long cord is attached to the ring. When thus accoutred, the fish, placed in a vessel of seawater, is carried out in a boat; and as soon as the fishermen perceive a sleeping turtle, they row gently towards it, and throw the remora into the water, with a sufficient length of cord. It seldom fails speedily to attach itself to the unconscious turtle, which by the tenacity of its adherence is immediately drawn towards the boat and captured.

A third species of remora is described by Mr Archibald Menzies as an inhabitant of the Pacific Ocean.¹ He has named it *Ech. lineata*. It is distinguished by having only ten transverse plates to its sucker. Mr Menzies found it adhering to a turtle. A fourth species (and these are all with which we are acquainted) has been more recently discovered by Baron Cuvier. The rays of its pectoral fins are bony, compressed, and terminated by a slightly notched *pallette*. He names it *Echeneis osteochir*.²

ORDER IV.—MALACOPTERYGII APODES

which may be considered as constituting a single natural family, the

Malacop-
terygii
Apodes.
Anguilli-
formes.

ANGUILLIFORMES,

or fishes with an elongated shape; a thick skin, on which scales are in general but indistinctly visible; and without *cæca* to their intestines. Almost all are provided with a swimming bladder, which often assumes a remarkable form.

The ancient unrestricted GENUS *MURÆNA* of Linnæus is distinguished by the snake-like form of the body; the small opercles covering concentric branchiostegous rays, buried in the skin, and only opening posteriorly by a sort of tubular orifice. This structure, by giving a more perfect command over the closure of the gills, enables them to remain longer out of water without injury than the generality of fishes. They have scarcely-perceptible scales, which are concealed in a tough skin, covered with a slippery mucus. They all are destitute of ventral fins and *cæca*, and have the anus placed very far behind. Numerous subdivisions of the old genus *Muræna* have taken place in modern times. We shall here note the following:

GENUS *ANGUILLA*, Thunberg and Shaw. Eels in general, as distinguished from *Muræna*, are characterised by the possession of pectoral fins, under which the branchial aperture opens; their swimming bladder has an elongated shape, and near its middle a peculiar glandular body; their stomach has a long cul-de-sac; their intestine is almost straight.

The more restricted genus *ANGUILLA*, or *eel properly so called*, has the dorsal and caudal fins continued around the tail, giving it a pointed form.

In the *true* eels, the dorsal begins a considerable distance behind the pectorals. Some have the upper jaw shorter than the lower; such as the *Anguilla vulgaris*, or common eel. (Plate CCCVI. fig. 1.) This fish is universally distributed, and scarcely requires description. The usual colour is an olive tint above, and a silvery colour below; but in some instances the back is spotted with brown. We have observed these fish in considerable numbers leaving fresh-water lakes in the night time, and frequenting meadows, seemingly for the purpose of preying on slugs and snails. They easily move on the land, with a motion resembling that of snakes. The eel grows to the size of two or three feet, and is sometimes said to reach five or six feet in length. It abounds in many European rivers. Eels are caught in immense numbers in the rivers emptying themselves into the Baltic; and they form a considerable article of trade. Two thousand are stated to have been caught at one sweep in Jutland; and in the Garonne 60,000 were taken in one day by a single net.

"That eels migrate towards brackish water," observes Mr Jesse, "in order to deposit their roe, I have but little doubt, for the following reasons. From the month of November until the end of January, provided the frost is not very serious, eels migrate towards the sea. The Thames fishermen are so aware of this fact, that they invariably set their pots or baskets with their mouths up stream during those months, while later in the spring and summer they are set down stream. The best time, however, for taking eels, is during their passage towards the sea. The eel-traps, also, which are set in three different streams near Hampton Court (the contents of which, at different times, I have had opportunities of ex-

¹ Linn. Trans. vol. i. p. 187, pl. xvii.

² Règne Animal, t. ii. p. 348.

Malacop-
terygii
Apodes.
Anguilli-
formes.

aming), have invariably been supplied with eels sufficiently large to be breeders, during the months I have mentioned. This migratory disposition is not shown by small eels; and it may therefore be assumed that they remain nearly stationary till they are old enough to have spawn. I have also ascertained that eels are taken in greater or lesser numbers during the months of November or December, all the way down the river to the brackish water. From thence the young eels migrate, as soon as they are sufficiently large and strong to encounter the several currents of the river, and make their way to the different contributory streams. I have also been able to trace the procession of young eels, or, as it is called here, the *eel-fair*, from the neighbourhood of Blackfriar's Bridge, as far up the river as Chestrey, although they probably make their way as far, or farther than Oxford. So strong, indeed, is their migratory disposition, that it is well known few things will prevent their progress, as, even at the locks at Teddington and Hampton, the young eels have been seen to ascend the large posts of the flood-gates, in order to make their way, when the gates have been shut longer than usual. Those which die stick to the posts; others, which get a little higher, meet with the same fate, until at last a sufficient layer of them is formed to enable the rest to overcome the difficulty of the passage. A curious instance of the means which young eels will have recourse to, in order to perform their migrations, is annually proved in the neighbourhood of Bristol. Near that city there is a large pond, immediately adjoining which is a stream. On the bank between these two waters a large tree grows, the branches of which hang into the pond. By means of these branches, the young eels ascend into the tree, and from thence let themselves drop into the stream below, thus migrating to far distant waters, where they increase in size, and become useful and beneficial to man. A friend of mine, who was a casual witness of this circumstance, informed me that the tree appeared to be quite alive with these little animals. The rapid and unsteady motion of the boughs did not appear to impede their progress.¹

"All authors agree," adds Mr Yarrell, "that eels are extremely averse to cold. There are no eels in the arctic regions, none in the rivers of Siberia, the Wolga, the Danube, or any of its tributary streams. It is said there are no eels in the Caspian or Black Seas, but they abound in the Mediterranean; and M. Risso has described eight species in his work on the Natural History of the Environs of Nice. There is no doubt, also, that fishes in general, and eels more particularly, are able to appreciate even minute alterations of temperature in the water they inhabit. The brackish water they seek to remain in during the colder months of the year, is of a higher temperature than that of the pure fresh water of the river, or that of the sea. It is a well-known law in chemistry, that when two fluids of different densities come in contact, the temperature of the mixture is elevated for a time, in proportion to the difference in density of the two fluids, from the mutual penetration and condensation. Such a mixture is constantly taking place in rivers that run into the sea, and the temperature of the mixed water is accordingly elevated."² As eels are well known to breed in ponds, it may be inferred that their descent to the brackish water, though customary, is not indispensable. They sometimes attain a great size. The species (or variety) called the *sharp-nosed silver eel* has been taken near Cambridge of the weight of twenty-seven pounds.

Some authors make a separate division of the CONGERS

(*Conger*, Cuv.), which chiefly differ from the common eels in having the upper jaw the longest, and the dorsal fin commencing almost over the pectorals. The chief species are the following: *Anguilla conger* (Plate CCCVI. fig. 3) grows to the size of six feet or more, and is as thick as a man's leg. The conger is found around all our coasts. The skin has a leaden hue above, and is white below, with darker spots along the sides. The dorsal is bordered with black. The teeth are sharp, and when captured the fish is capable of giving very severe bites. The fishermen are stated also to dread injury to their legs from a large conger twining round them. It has been said to attack swimmers by coiling round them, and preying on their bodies. It is voracious, and has not unfrequently been found within the carcasses of dead animals, on which it was evidently feeding. The conger fishery was at one time of some consequence on the Cornish coasts, for the supply of Spain and Portugal. The fish were cured by drying, during which they lost much fat. *Anguilla myrus* (Rondelet) has a sharp snout, a thin roundish body of a dark colour, without spots, except toward the head, where a few yellowish dashes are seen; as also a whitish transverse band on the occiput, and two rows of small specks on the back of the neck. This species occurs in the Mediterranean, as do several other small congers, such as *A. balearica*, *mystax*, and *nigra*. The last named lives among the rocks near Nice, and attains to the weight of forty pounds. Its flesh is more esteemed than that of the common kind.

The GENUS *OPHISURUS*, or *snake-tail*, differs from the eels properly so called, by the dorsal and ventral fins terminating abruptly before reaching the extremity of the tail, which is thus deprived of fin, and ends in a sharpened point. The intestine resembles that of the eels; but a portion of it extends into the tail, farther back than the anus. The teeth are sharp and cutting. *Ophisurus serpens* is a Mediterranean species, marked by a triple chain of large, dark-brown, oblong spots, on a silvery-white body. It grows to the length of six feet, and is as thick as the human arm. The snout is sharp; the branchial membrane has twenty rays. *Ophisurus guttatus*, a handsome species from Guyana, belongs to this subdivision; as does *O. ophis*, the *Muraena ophis* of Bloch. In some Ophisuri the pectoral fins are small, and sometimes almost imperceptible; a circumstance which assimilates them to the *Muraena*. Such are *O. colubrinus*, *fasciatus*, and *maculosus*.

GENUS *MURÆNA*, Thunberg. The species were united by Linnæus to the eels; but they are distinguished sufficiently by the total want of pectoral fins. Their branchial apertures are minute lateral holes; their opercles are so small, and their branchiostegous rays so slender, and so concealed within the skin, that some able naturalists have denied their existence in this genus. Their stomach is a short pouch; and their swimming bladder is small, oval, and placed towards the upper part of the abdomen. Some of them have the dorsal and anal fins distinctly visible; some have obtuse, others sharp cutting teeth, and the latter can bite severely.

The best known is *Muraena Helena*, or *Roman muraena* (Plate CCCVI. fig. 2), which abounds in the Mediterranean, and was introduced by the luxurious Romans of antiquity, in crystal vases, to the table before being cooked, that the guests might admire its variegated skin. This fish is very voracious, and feeds on all sorts of animal matter. The Romans fed them in ponds, and Pliny has recorded the atrocities of Vedius Pollio, who used to punish his offending slaves by throwing them alive to his *muraenæ*. We have seen this fish repeatedly taken at

Malacop-
terygii
Apodes.
Anguilli-
formes.

¹ *Gleanings in Natural History*, second series.

² *Ibid.*

Malacop-
terygii
Apodes.
Anguilli-
formes.

Malacop-
terygii
Apodes.
Anguilli-
formes.

Gibraltar, between three and four feet in length. The skin is beautifully marbled with yellow sub-angular markings on a rich brown ground. When captured in nets it lives long out of the water, and is capable of biting very severely, from the sharpness of its numerous teeth. A very beautiful *Muraena* with obtuse teeth, *M. catenata*, is found in the rivers of Guyana; its colours are brown and white. In the same region is found *M. zebra*, a species beautifully marked, on a dark-brown ground, with transverse, linear, distant bands, meeting irregularly beneath. Other species are, *M. reticularis*, *M. punctata*, *M. unicolor*, *M. Haüy*, *M. picta*, *M. meloagris*, *M. grisea*, *M. afra*, *M. stellata*, *M. undulata*, *M. sordida*.

GENUS SPHAGEBRANCHUS, Bloch. This genus differs from *Muraena* chiefly in having the branchial apertures close together, and beneath the throat, instead of being on each side of the neck. The snout is sharp, and projecting far beyond the mouth; the dorsal and anal fins, when perceptible, do not commence until within one third of the length of the fish from the extremity of the tail. Some of them have no appearance of pectoral fins; others have slight vestiges of those parts. One of them, *Sph. cæcus* (Genus *Apterichtes*, Dumeril), is absolutely without any fins at all. The stomach has a long cul-de-sac; the intestine is straight; and all have a long narrow swimming bladder placed towards the posterior extremity.

The best known is *Sphagebranchus rostratus*, first noticed by Bloch. It grows to a length of nine inches. *Sph. imberbis* was described by Laroche in *Ann. du Mus.* xiii. as well as *Sphag. cæcus*, which he considered as a *muraena*.

GENUS SYNBRANCHUS, Bloch. This division is distinguished from the last by having only a single branchial orifice, which is placed under the throat, and communicates with the gills on each side. The fishes included in it are totally without pectorals, and their vertical fins are almost entirely adipose. Their head is thicker than any part of the body, and short; the mouth is wide, lips fleshy, teeth small, conical, and in several rows. Their opercles are partly cartilaginous; their branchial rays are very strong; their swimming bladder is long and narrow. They have no cæca to the intestine, which is straight, and can scarcely be distinguished from the stomach except by a kind of pyloric valve. The species inhabit the seas of the hotter parts of America, especially Surinam. Two only are known, *Synbranchus marmoreus* (Plate CCCVI. fig. 4) and *Syn. immaculatus*. They have much the habit of water-snakes.

In succession to the preceding generic subdivisions of the Linnæan *Muraena*, Cuvier places a singular and recently discovered species, the *Saccopharynx flagellum* of Dr Mitchell. Its body is capable of great inflation. It is a large and voracious fish, measuring about six feet in length, with a deep cleft mouth armed with sharp teeth. It has hitherto been found only in the Atlantic Ocean, where it floats on the surface by means of the inflation just alluded to.¹

GENUS GYMNOTUS, Linn. The gymnotes, like eels, have the gills partly shut up by a membrane, which, however, opens before the pectoral fins; the anus is placed near the head; the anal fin runs along nearly the whole under part of the fish, and generally reaches to the extremity of the tail, but is not continued along its upper portion.

In GYMNOTUS, Lacép. *properly so called*, the skin is without visible scales; the intestine, in several convolutions, occupies but a moderate space, and has many cæca; the stomach is a short, blunt sac, with numerous rugæ

within. Some of them have two swimming bladders; the anterior is ovate and bilobular, and lies on the œsophagus, at the top of the abdomen; the posterior is cylindrical, and occupies a sinus in the abdominal cavity. The true gymnotes are confined to the rivers of America. The best-known species is *Gymnotus electricus*, or electric eel (Plate CCCVI. fig. 5). This animal has been well described by Dr Garden of Charlestown, by John Hunter, and by Humboldt. It is remarkable for the violence of its electric shocks, which are often so powerful as to stupify a man or a horse. The researches of Hunter detected an organ in the posterior part of this fish, resembling the electric apparatus of the torpedo. See Plate CCCVI. fig. 6. This organ consists of four longitudinal fasciculi, which occupy one half the thickness of the part in which they occur, and about one third of the whole animal. The larger pair lie above, the smaller below. Each fasciculus is composed of flat partitions or septa, with transverse divisions between them. The outer edge of the septa appear in nearly parallel lines in the direction of the longitudinal axis of the body, and consist of thin membranes, which are easily torn; they serve the same purpose as the columns in the analogous organ of the torpedo, making the walls or abutments for the perpendicular and transverse dissepiments, which are exceedingly numerous, and so closely aggregated as to seem almost in contact. The minute prismatic cells, intercepted between these two sorts of plates, contain a gelatinous matter; the septa are about one thirtieth of an inch from each other, and one inch in length contains a series of 240 cells, giving an enormous surface to the electric organs. The whole apparatus is abundantly supplied with nerves from the medula spinalis; and these nerves are seen coming out in pairs from between the vertebrae. In their course they give out branches to the muscles of the back, and to the skin of the animal. In the gymnote, as in the torpedo, the nerves supplying the electric organs are much larger than those bestowed on any part for the purposes of sensation or movement. Hunter thinks, however, that these nerves are more considerable in point of size in the torpedo than in the gymnote. These organs are attached loosely to the muscles of the back which lie between the larger, and they are immediately connected with the skin by a loose cellular texture. Humboldt has given a very interesting and lively description of the mode of capturing the electric gymnote, as practised in South America, near the town of Calabozo.

These fish abound in the stagnant pools of that vicinity. The Indians are well aware of the danger of encountering the gymnote when its powers are unexhausted. They therefore collect twenty or thirty wild horses, force them into the pools, and when the fish have exhausted their electric batteries on the poor horses, they are laid hold of without difficulty. The horses at first exhibit much agitation and terror; they are prevented leaving the pool by an enclosing band of Indians, who goad them with bamboos whenever they attempt to escape. "The eels," says Humboldt, "stunned and confused by the noise of the horses, defended themselves by reiterated discharges of their electric batteries. For some time they seemed likely to gain the victory over the horses and mules; these were seen in every direction, stunned by the frequency and force of the shocks, to disappear under water. Some horses, however, rose again, and, in spite of the active vigilance of the Indians, gained the shore, exhausted with fatigue; and their limbs being benumbed by the electric explosions, they stretched themselves out upon the ground." "I remember the superb picture of a horse entering a cavern,

¹ *Ophiognathus ampullaceus* of Mr Harwood, *Phil. Trans.* 1827, seems to pertain to the same genus.

Malacop-
terygii
Apodes.
Anguilli-
formes.

and terrified at the sight of a lion. The expression of terror is not there stronger than what we witnessed in this unequal conflict. In less than five minutes two horses were already drowned. The eel, more than five feet long, glides under the belly of the horse or mule; it then makes a discharge from the whole extent of its electric organs, which at once attacks the heart, the viscera, and especially the gastric plexus of nerves." "After this commencement, I was afraid that the sport might end very tragically. But the Indians assured us that the fishing would soon be finished, and that nothing is to be dreaded but the first assault of the gymnotus. In fact, whether the galvanic electricity is accumulated in repose, or the electric organ ceases to perform its functions when fatigued by too long-continued use, the eels, after a time, resemble discharged batteries. Their muscular motion is still equally active, but they no longer have the power of giving energetic shocks. When the combat had lasted a quarter of an hour, the mules and horses appeared less affrighted; they no longer bristled up the mane, and the eye was less expressive of suffering and of terror. They no longer were seen to fall backwards; and the gymnotes, swimming with the body half out of the water, and now flying from the horses instead of attacking them, began themselves, in their turn, to approach the shore."

The electric gymnote is by no means fierce or voracious; but its electric organs are the instruments by which it procures its prey, and defends itself against alligators and other enemies.

It has been several times brought alive to Europe, and some experiments have been made on its electricity,—which is conducted and insulated by the same substances as common galvanism.¹

So common is the gymnotus in some parts of South America, that, in the neighbourhood of Uritucu, a route at one time much frequented has been entirely abandoned, in consequence of the necessity of fording a stream, in which many mules were killed every year by these subaqueous electric shocks.

The only other known species of gymnotus is the *G. æquilabiatus* of Humboldt, which appears to differ from the other in wanting the posterior swimming bladder.

The GENUS CARAPUS was separated by Cuvier from the gymnotes, with which they were formerly confounded; and the species are distinguished by a scaly compressed body and a slender tail. The appellation is derived from their Brazilian name. All the species live in the rivers of South America, or on the coasts of that country. *Carapus macrourus* grows to the length of eighteen inches or two feet, and is of a brown colour, with small eyes, and slender tail. *C. brachiurus vel fasciatus* is marked with darker transverse bands. *C. albus* is of a whitish colour; tail naked for about an inch; upper lip with a lobule on each side; several pores on the sides of the head. *C. rostratus* has a body like that of *C. macrourus*, but the snout is narrow, compressed, and tubular, with connate jaws; colour pale brown, variegated with darker spots; the scales not visible.

The GENUS STERNARCHUS of Schneider was so denominated from the anus being near the sternum. The anal fin ends before it reaches the extremity of the tail, which has a fin of its own; but the most singular character in the structure of this fish consists of a soft fleshy filament, concealed in a furrow on the dorsum, beyond the middle of the back, and retained in this groove by tendinous threads, which admit of its having some motion; a very singular

organ, of which we cannot conjecture the use. The head is oblong, naked, and compressed; neither opercula nor branchial rays are externally visible; the rest of the body is scaly; the teeth are soft, short filaments, like velvet, on the middle of each jaw. The only species is *Sternarchus albifrons*, which was considered by Pallas, its first describer, as a *Gymnotus*.

GENUS GYMNARCHUS, Cuv. Body scaly and elongated, gills but slightly open in front of the pectorals, as in *Gymnotus*, but the back is furnished all along with a soft rayed fin; there is no fin behind the anus, nor beneath the tail, which has a pointed termination. The head is conical, naked,—the mouth small, and provided with a single row of small cutting teeth.

Gymnarchus Niloticus of Cuvier, discovered by M. Riffault, is, as its name implies, an Egyptian fish, and is, we believe, the only known species.

GENUS LEPTOCEPHALUS, Pennant. This genus differs from the eels by being greatly compressed laterally, by a larger branchial aperture opening before the pectorals, by a head extremely small, and a pointed snout. The pectorals are almost invisible; the dorsal and anal are very small, and unite at the point of the tail. The intestines occupy a narrow line along the inferior margin of the body.

Only one species is known, a native of our own seas, first described by Pennant. It is the *Leptocephalus Morrisii*, a small fish of four inches long by one tenth of an inch in thickness, and so transparent as almost to exhibit the form of the vertebræ, which may also be felt through the integuments. This singular creature was first seen near Holyhead by Mr William Morris, who transmitted it to Pennant. Though still a rare species, it has since been observed by several other British naturalists.

GENUS OPHIDIUM, Linn. This genus has the anus far behind; the dorsal and anal fins join in a point at the tail; the body is long and compressed, and covered with small irregular scales, scattered in the thickness of the skin. But these fish differ from eels, in having open gills, furnished with a large operculum, and a branchiostegous membrane, with short rays. The dorsal rays are articulated, but not branched.

The genus is subdivided into two sub-genera, viz. *Ophidium proper*, in which the throat is provided with two cirrhi adhering to the point of the os hyoides. The best-known species is *Ophidium barbatum*, which grows to eight inches; general colour silvery, but the vertical fins banded with black; the surface smooth, scales attached by their centre to the skin; two bifid cirrhi on the throat; skin spotted with small red spots. The swimming bladder is oval, large, and thick, for the size of the fish, and is supported by three peculiar bones suspended under the first vertebra, and moveable by particular muscles. This fish abounds in the Mediterranean, where it is in request as an article of diet. *Ophidium Vassali* is a small species, also found in the Mediterranean; but in the South Seas a large species has been caught. It is named *Oph. blacodes*. ENCHELYOPUS (FIERASFER), Klein, differs in wanting the beards of the true *Ophidium*. The dorsal fin is so slight as only to seem a fold of the skin; the swimming bladder has but two supporting bones. Only one species is recognised, *Ophidium imberbe* of Linn., which is also *Gymnotus acus* of several naturalists. As a British species, it was first communicated to Pennant by the Duchess of Portland, from Weymouth. It has since been found by Montagu on the south coast of Devon.

Malacop-
terygii
Apodes.
Anguilli-
formes.

¹ Dr Traill informs us that he had two sent to him from Demerary, but they died the day before the ship made the coast of England, and were unluckily thrown overboard.

Lophobranchii.

GENUS *AMMODYTES*, Linn. Has a thin and elongated form. The dorsal fin is furnished with articulated rays, but is simple for a considerable part of its extent. There is a second fin behind the anus, and a third at the end of the tail, which is forked. These three fins are quite distinct, or separate from each other. The snout is pointed; the upper jaw susceptible of extension, but the lower is longer than the upper when the latter is not extended. The stomach is angular and fleshy; there is no swimming bladder nor cæca. Only one British species is as yet distinctly known, the *Ammodytes tobianus* (our common launce), a fish about eight or ten inches long, the body somewhat of a square form, but the angles not sharp, and the sides slightly convex. It is very frequent on our sandy coasts. Its back is bluish, the rest rich silvery. This fish lives on vermes and other marine animals, which it is believed to pursue by burrowing in the sand, from whence it is often dug up at the depth of a foot. It is prized as food, and is considered as an excellent bait for turbot and mackerel. It is the favourite prey of the latter fish; and the porpoise ploughs up the sand at the bottom of the sea with his nose, in the manner of a hog, in search of this species, which has often been found in his stomach. It is also sought for by salmon, which have been captured in the sandy bays of Sutherland, by means of a hook baited by a launce, commonly called the *sand-cel*.

It is extremely probable that two British species are usually confounded by us under the name of launce.¹

The various genera of fishes with which we have been hitherto engaged, not only possess an osseous or fibrous skeleton, and free and complete jaws, but their branchiæ are constantly pectiniform, that is, in the shape of laminæ or combs. We now proceed to others, in which the respiratory organs assume another form.

ORDER V.—LOPHOBRANCHII.

Jaws complete and free, as in the preceding orders, but the branchiæ, instead of being comb-shaped, are divided into little rounded tufts, disposed in pairs along the branchial arches. The branchiæ have this further peculiarity, that they are entirely enclosed beneath a large operculum, attached all round by a membrane, which permits the water to escape merely through a small hole, and exhibits only vestiges of rays.

The genera of this order may be distinguished externally by the *cuirassèd* aspect of their bodies, which are strongly plated, very angular, and frequently furnished with spiny projections. The species are meagre creatures, of small size, and very extraordinary aspect. They have scarcely any *flesh* upon their bones. The intestine is uniform, and without cæca; the swimming bladder is thin, but tolerably large in proportion to the other parts. The order is almost entirely composed of the old genera *Syngnathus* and *Pegasus* of Linnæus.

The genus *SYNGNATHUS* of the great Swedish naturalist consisted of a rather numerous assemblage of species, distinguished by a tubular muzzle, formed, like that of the *FISTULARIÆ*, by a prolongation of the ethmoid, vomer, and tympanic bones, of the pre-opercles, sub-opercles, &c. and terminated by a mouth of the ordinary kind, but almost vertically cleft. The respiratory opening is towards the nape of the neck, and the ventral fins are wanting. The generative system is characterised by this peculiarity, that the eggs slip into, and are hatched in, a kind of sac or

pocket, formed by a pursing of the skin—in some beneath the belly, in others at the base of the tail. This pouch opens in due time for the escape of the young. In this respect, then, these fishes may be said to connect the osseous with the cartilaginous kinds, for the eggs are hatched internally, and the young are produced alive. This fact was observed by Aristotle, and has lately been confirmed (so far, at least, as concerns *S. acus*) by Cavolini. The genus is now subdivided into three minor groups, as follows:—

1st, Genus *SYNGNATHUS* properly so called. Body very long, thin, and differing but little in its diameter throughout. Several species occur in all our seas. They differ in the character and number of their fins.

2d, Genus *HIPOCAMPUS*, Cuv. Body laterally compressed, and obviously higher than at the tail. The surface is raised into ridges, its edges are angular and incised, and the hinder parts of the body and tail have the appearance of being divided into segments. The caudal fin is wanting.

Of this genus several species are found in the European seas, and one or two occur along the British shores. The greater number, however, are exotic. In the dried specimens the head is usually bent at right angles with the body, the thorax curved, and the tail bent inwards. From the peculiar aspect which they exhibit in this condition, they have received the name of *sea-horses*. The most remarkable species with which we are acquainted is the *Hippocampus foliatus* of Shaw, or foliated pipe-fish. (See Plate CCCVI. fig. 7.) This rare and very singularly constructed fish is a native of the Southern Ocean. The specimen described by Shaw was transmitted from New Holland to Sir Joseph Banks. The one here figured was sent to Professor Jameson from Van Diemen's Land. We should not have hesitated to consider this species as synonymous with *S. tenuilatus* of Lacépède (and the more readily as they seem to be regarded as identical by Cuvier²); but on comparing it with the figure in the *Annales du Mus.* we find that the Van Diemen's Land specimen possesses two large appendages on the dorsal outline, not represented by the author of the earlier *Hist. Nat. des Poissons*.

3d, Genus *SOLENOTOMA*, Seb. and Lacép. Differs from *Syngnathus* chiefly in possessing very large ventrals placed behind the pectorals, and united together and with the body so as to form a kind of apron, which, like the pouch of the genus just named, serves to retain the ova. There is also a dorsal, with few rays, but elevated, and placed near the nape; another very small fin on the origin of the tail; and a large pointed caudal. In other respects the genus bears a great resemblance to *Hippocampus*. There is only a single species known, the *Fistularia paradoxa* of Pallas.³

GENUS *PEGASUS*, Linn. Projecting muzzle formed by the same pieces as in the preceding genera, but the mouth, instead of being placed at the extremity, is found at the base, and, in its protractile nature, so far resembles that of the sturgeon, although it is composed of the same bones as the mouth of ordinary fishes.

The body in this genus is cuirassèd like that of *Hippocampus* and *Solenostoma*, but the trunk is broad, depressed, the branchial opening lateral, and there are two distinct ventral fins behind the pectorals, which are often large and wing-like, and have given rise to the generic name. The dorsal and anal are opposite to each other. The species are chiefly from the Indian seas. See Plate CCCVI. fig. 10.

Lophobranchii.

¹ See *Règne Animal*, t. ii. p. 360; and *Bulletin des Sciences* for September 1824.
Règne Animal, t. ii. p. 363.

³ *Spicilegia*, viii. iv. 6.

Plectog-
nathi.
Gymno-
dontes.

ORDER VI.—PLECTOGNATHI.

The fishes of this order approach the great chondropterygian division in the imperfection of their jaws, and the slowness with which their skeleton hardens; yet that skeleton is fibrous, and its general structure resembles that of the ordinary or osseous fishes. The principal distinctive character, however, of the Plectognathi, consists in the maxillary bone being soldered or firmly attached on the side of the inter-maxillary, which alone forms the jaw, and in the palatine arch being connected by suture with the cranium, which consequently renders it immovable. Moreover, the rays and opercles are concealed beneath a thick skin, which permits only a small branchial cleft to be visible externally. The vestiges of ribs are very slight. The true ventrals are wanting. The intestinal canal is ample, but without cæca, and almost all the species are provided with a rather large swimming bladder.

The order comprises two very natural families, characterised by the different armature of the jaws.

FAMILY I.—GYMNODONTES.

Instead of apparent teeth, the jaws are furnished with a substance like ivory, divided internally into laminæ or plates, the totality of which resembles the beak of a parrot, and is essentially composed of true teeth united together, and succeeding each other as they become used by trituration. The opercles are small, their rays five in number on each side, and the whole greatly concealed. The species live on Crustacea and Fuci. Their flesh is in general mucous, and slightly esteemed. Some indeed are even poisonous, at least during certain seasons.

Two of the genera (*Tetraodon* and *Diodon*), commonly called orbs or balloon-fish, possess a singular faculty of inflating their bodies by swallowing great quantities of air. When thus swollen, they roll over and float upon the surface, belly uppermost, apparently unable to direct their course. They are not, however, defenceless, for the spines with which their skin is armed project in all directions. Their swimming bladder has two lobes, and their kidneys, which are placed very high up, have been sometimes mistaken for lungs. There are but three branchiæ on each side. Each nostril is furnished with a double fleshy tentaculum.

GENUS *DIODON*, Linn. The undivided jaws exhibit but one piece above and another below,—from whence the generic name, which signifies *two teeth*. Behind each cutting edge is a rounded portion, transversely grooved, and forming a powerful instrument of mastication.¹ The skin is armed on all sides by strong, pointed spines, so that, when inflated, these creatures bear a resemblance to a gigantic burr of a chestnut tree.

The species are numerous in the warmer seas. One of the most common is the *Diodon atinga* of Bloch, which measures about a foot in diameter. It inhabits the seas of India, America, and Southern Africa, and feeds on the smaller fishes, Crustacea, and shell-fish, the calcareous covering of which it breaks with great facility, by means of its robust and bony jaws. It is a dangerous species to meddle with, owing to the sudden and hedgehog-like manner in which it bristles up its spines. It seems synonymous with *D. hystrix* of Linn., commonly called the sea-porcupine, and was formerly a frequent and dusty ap-

pendage in the shop of the apothecary. (See Plate CCCVI. fig. 8.) *Diodon holocanthus* inhabits almost all the seas between the tropics. When taken by means of a hook, it exhibits the most ungovernable movements,—alternately inflates and compresses its body, ascends and descends with rapidity and violence, and is extremely dangerous to lay hold of. It is fished for both in the Red Sea and along the coast of Japan; and, according to Duterre, the hooks are baited with Crustacea. The bait, it appears, is first approached with caution, then tasted, left, returned to, and finally swallowed. It no sooner, however, finds itself fairly hooked, than it swells itself up like a balloon, utters a dull sound like that produced by a turkey-cock while making its wheel, and then becomes exceedingly furious. It next has recourse to an opposite mode of action, by lowering its spines, disinflating its body, and becoming as loose and flabby as a wet glove.² It resumes its activity, however, as soon as it perceives the fisherman drawing towards it, or feels itself being drawn towards the fisherman. In short it has a particular dislike to being killed.

GENUS *TETRAODON*, Linn. Jaws divided in the centre by a suture, so as to exhibit the appearance of four teeth (from whence the name), two above and two below. The skin is armed merely by small spines, which project but little. Several species are regarded as poisonous.

The most anciently known is an Egyptian species, *T. lineatus*, Linn., which is thrown by the floods in vast numbers over the prolific banks of the Nile, where it is afterwards gathered as a plaything by the children. According to Hasselquist, however, the Egyptians hold it in abhorrence, and believe that the use of its flesh as food is followed by death. The prickles of its skin produce a sensation like the stinging of nettles. In many Mahomedan countries another species, called *T. hispidus* by Lacépède, is fully inflated, then carefully dried, and afterwards suspended from the pinnacle of the minarets, where it serves the purpose of a weathercock. The hare tetraodon, as it is called (*T. lagocephalus*, Linn.), appears to have been described by Pennant under the title of *Globe Diodon*. Though a tropical species, it has occurred occasionally along the British coasts, particularly near Penzance in Cornwall. We here figure a curious Indian species, the *Tetraodon patoca* of Dr Hamilton Buchanan. Plate CCCVI. fig. 9.

Baron Cuvier has separated from the preceding, under the generic title of *ORTHAGORISCUS* (imposed by Schneider, and synonymous with genus *Cephalus* of Shaw), the peculiar species known to English readers under the name of *sun-fish*, the *Poissons-lunes* of our continental neighbours.³ The jaws are undivided, as in *Diodon*, but the body, compressed and without spines, is unsusceptible of inflation, and the tail so short, and vertical in its posterior outline, as to convey the idea of an artificial truncation. The form is in consequence extraordinary and characteristic. The dorsal and anal fin, each high and pointed, seem to unite with the caudal. The swimming bladder is wanting, the stomach small, and penetrated directly by the *ductus choledocus*. Beneath the skin we find a thick layer of a gelatinous nature. The European seas produce a species which sometimes measures more than four feet in length, and weighs, in consequence of its bulky proportions, above three hundred pounds. It is of a fine silvery hue, and is named *Tetraodon mola* by Linnaeus, and the *short sun-fish* by British writers. (See Plate CCCVI. fig. 11.) It often exhibits during the night a high

Plectog-
nathi.
Gymno-
dontes.

¹ Baron Cuvier observes, that the jaws of these fishes are by no means unfrequent among petrifications.

² Griffith's *Animal Kingdom*, vol. x. p. 581.

³ The title of *Poisson-lune* is however bestowed also on other species by French writers, for example on *Lampris guttatus* of Retzius, which is the *Zeus luna* of Gmelin, and the *Opch* of Pennant.

Plectognathi. Sclerodermi. degree of phosphoric splendour. We once came alongside of one while swimming in the Mediterranean. It got out of our way by sinking very slowly downwards. The *Diodon mola* of Pallas (*Spic. Zool.*) is another species of the same genus.

The only remaining genus of the first family of PLECTOGNATHI is named TRIODON by Cuvier, from a species discovered in the Indian seas by M. Reinward.¹

FAMILY II.—SCLERODERMI.

Easily distinguished by the conical or pyramidal form of the muzzle, prolonged from the region of the eyes, and terminated by a little mouth armed with a small number of distinct teeth on each jaw. The skin is generally rough, or covered by hard scales. The swimming bladder is large and robust, and of an oval form.

GENUS BALISTES, Linn. Body compressed; eight teeth upon a single row on each jaw, and generally of a cutting kind; skin scaly or engrained, but not absolutely osseous; first dorsal composed of one or more spines, articulated on a special bone, which is attached to the cranium, and presents a groove into which the spines are received; second dorsal soft and long, and corresponding in its position to an anal fin of nearly similar form. Although the ventral fins are wanting, we nevertheless perceive in the skeleton a true pelvic bone suspended to those of the shoulder.

The species occur in vast numbers in the torrid zone, among rocks nearly on a level with the surface of the water, where they shine with a brilliant lustre resembling that of the beautiful chætodons, formerly described. Their flesh, at no time much esteemed, is said to become dangerous as food while they themselves are nourished by the polypi of the coral reefs. Cuvier however states, that in such specimens as he had occasion to dissect, he found nothing but the remains of marine vegetation. The generic name is derived from *balista*, an ancient implement of war, to which the inclined dorsal spine has been regarded as bearing some resemblance. In modern times the original genus has been divided into the four following groups.

In BALISTES (properly so called) of Cuvier, the whole body is clothed by large, hard, rhomboidal scales, which not being imbricated, or encroaching on each other, present the appearance of compartments on the skin; their anterior dorsal has three spines, of which the first is much the largest, the third being very small, and placed somewhat apart behind. The extremity of the pelvis is always prickly and projecting, and behind it are some spines involved in the skin, which in the lengthened species have been regarded as rays of the ventral fins. Some have no particular armature on the sides of the tail; others have the lateral portion of that part armed by a certain number of ranges of spines curved forwards.

In MONOCANTHUS, Cuv., the scales are very small, and beset by close asperities; the extremity of the pelvis is projecting and spiny, as in the preceding group, but there is only one large dentated spine to the first dorsal, or, if the second exists, it is almost imperceptible.

In ALUTERES, Cuv., the body is elongated, and covered by scarcely visible, small, close-set grains; there is a single spine to the first dorsal; and the pelvis is entirely subcutaneous, not forming that spiny projection visible in the other *Balistes*. See Plate CCCVI. fig. 12.

In TRIACANTHUS, Cuv., the species are distinguished by possessing a kind of ventral fins, each sustained by a large

single spiny ray, and adhering to an unprojecting pelvis. Chondropterygii. The first dorsal, posterior to its principal spine, has three or four smaller ones. The skin is covered by small, close-set scales, and the tail is more elongated than in the other groups. There is only one species known, a small fish from the Indian seas, figured by Bloch (148, 2) under the name of *Balistes bi-aculeatus*.

GENUS OSTRACION, Linn. Instead of scales, the species of this genus have the head and body covered by regular and bony compartments, soldered together so as to form an inflexible cuirass, which leaves nothing moveable but the tail, fins, mouth, and a small lip which borders the gills. The majority even of the vertebral joints are also as it were soldered. Each jaw is armed with from ten to twelve conical teeth. The branchiæ open only by a small cleft, furnished with a cutaneous lobe; but internally they are provided with an opercle and six rays. Both the pelvic bones and ventral fins are wanting, and there is only a single dorsal and anal fin, each small of its kind.

These anomalous-looking fishes are sparingly supplied with flesh; but their liver is large, and yields an abundant supply of oil. Some are suspected of being poisonous. The species are called *trunk-fish* by our English writers. We here figure the horned trunk-fish, *Ostracion cornutus* of Linn. and Bloch, a native, like most of the genus, of the Indian and American seas. Plate CCCVI. fig. 13.

SECOND GREAT SERIES OF THE CLASS OF FISHES.

THE CHONDROPTERYGII, OR CARTILAGINOUS FISHES.

This division of fishes, by the peculiarities of the organs of hearing and generation in some genera, approaches to the class of reptiles; while others have a skeleton so defective, and such simplicity of organization, that we might almost arrange them with Vermes. We may thus consider them, says Cuvier, as bearing the same relation to the first series as the marsupial animals do to the other mammifera furnished with claws.

Their skeleton is distinctly cartilaginous, destitute of true bony matter, as the calcareous portion is not disposed into a fibrous structure, but is deposited in grains in a substance essentially gelatinous. The skull is composed of a single piece, and consequently is destitute of sutures, but possesses foramina, prominences, and fossulæ, like the cranium of other fishes. The facial articulations are also wanting; and it forms one of their characteristics to want the maxillary and inter-maxillary bones, which ordinarily support the teeth of the upper jaw; or they have only vestiges of these parts, while their functions are performed by bones analogous to the palatines or the vomer. In some the vertebral column, as in the lamprey, forms but a single piece; in others, as in certain rays, several vertebræ are joined together. The gelatinous inter-vertebral substance, which in other fishes communicates from one to another through a small foramen, is in several of this series a cord of equal thickness, perforating all the vertebræ. Yet their nervous system, connected with the organs of digestion, is as complete as in other fishes; and some of them have organs of copulation and generation quite as perfect as in the class of reptiles.

This series is divided into two orders; one distinguished by having the gills free, as in other fishes; the other with fixed branchiæ.

¹ See *Règne Animal*, t. ii. p. 370; and Duperrey's *Voyage, Poissons*, No. 4.

Chondropterygii.
Sturiones.

ORDER I.—STURIONES, OR CHONDROPTERYGII
WITH FREE BRANCHIÆ.

The few genera of this order approach to ordinary fishes, by their gills being attached only at one extremity. They have but one branchial aperture, which is very open; they have but one operculum, and are without rays to the membrane of the gills.

GENUS *ACIPENSER*, Linn.; Sturgeon. The general form of this genus resembles that of the sharks; but they are distinguished by longitudinal rows of bony plates or bosses implanted on the skin; the head is defended by similar plates; the mouth is small, and, as in sharks, placed below the snout; the palatal bones are united to the maxillaries, and vestiges of the inter-maxillaries may be traced in the lips, while the mouth is capable of some degree of projection, by its position on a style with three articulations. Instead of teeth, the mouth is furnished with a sort of horny process on the jaws. The nostrils and eyes are on the sides of the head; the muzzle is furnished with vermiform cirrhi. There is no vestige of an external ear, but the labyrinth is perfect within the bones of the head. The dorsal fin is behind the ventrals, and the anal immediately below the dorsal. The caudal fin surrounds the extremity of the spine, and its upper lobe is longer than the lower. Internally there exists the spiral intestinal valve, and the pancreas forming a single mass; but we also find a very large and strong swimming bladder, communicating by a wide aperture with the gullet. They prey on the smaller fishes, in pursuing which they can exert much speed; but in the rivers they frequent they are said to search for Vermes in the oozy bottom, which they explore with their snout, like swine.

Sturgeons are marine fishes, but at certain seasons they ascend in vast numbers particular rivers, where they are the subject of extensive fisheries, particularly in the large rivers that disembogue themselves into the Black Sea and Caspian, and the rivers of France and Prussia; they abound also in the large rivers of North America, where the species appear to be peculiar to that continent.

The European species are—

Acipenser sturio, or common sturgeon. Its ordinary length is seven or eight feet, but sometimes they are caught exceeding sixteen feet. Snout pointed, and furnished with cirrhi; body gradually tapering, pentagonal, from the disposition of six longitudinal rows of hard, bony, radiated, and mucronated tubercles. Its skin, except the flat belly, is rough, from small plates of a similar form; mouth a transverse oval orifice; lips cartilaginous; tongue thick; gill-covers consisting of an oval radiated plate; pectorals oval; dorsal near the tail. Its flesh is white and delicate, resembling veal. Its roe forms common *caviar*. This fish was highly prized by the ancients, and is still an esteemed food.

Acipenser ruthenus, or sterlet, is the smallest of European sturgeons, rarely measuring more than three feet long. It is very numerous in the Volga and Ural, and is uncommon in the Baltic. The lateral tubercles are very numerous, and strongly carinated; those of the under part of the body are more flattened. The flesh resembles delicate veal, and the roe forms the most highly prized *caviar*. See Plate CCCVII. fig. 1.

Acipenser huso, or isinglass sturgeon, is the largest of the genus, sometimes attaining the length of from twenty to thirty feet, and weighing from 1500 to between 2000 and 3000 lbs. Its skin is much less tuberculated than the com-

mon sturgeon, and is covered with a viscid mucus; the Chondropterygii. Sturiones. snout and cirrhi are shorter. This species is chiefly found in the Caspian and Euxine, or the rivers that flow into those seas; but the large sturgeons sometimes caught in the northern seas appear also to belong to the same species. The best isinglass is formed of its air-bladder.

The following species, which are found in the rivers of North America, appear to be peculiar to that continent (See *Amer. Trans.* vol. i.): *Acipenser brevirostris*, *A. oxyrinchus*, *A. maculosus*, and *A. rubicundus*. The last of these appears to be the American representative of the *A. ruthenus*, the preceding one of the *A. sturio*.¹

GENUS *POLYODON*, Lacép.; *SPATULARIA*, Shaw. This genus, which consists but of a single species, is at once recognised by the enormous prolongation of its snout, which has a dilated middle, something resembling the leaf of a tree when viewed from above. The habit of the body resembles the sturgeon; but the spinal column is formed of one piece, as in the lamprey. The upper jaw is formed of the maxillary and palate bones united together, and the pedicle of the mouth has two articulations; the mouth is small, and furnished with numerous minute teeth. The spiracle is wide, and covered by a very large, soft operculum, extending to the middle of the body. The intestine is provided with the spiral valve, so frequent among the Chondropterygii; but the pancreas exhibits the commencement of a subdivision into lobules. The existence of an air-bladder sufficiently distinguishes it from the *Squali*. It has only been found in the Mississippi, and does not exceed a foot in length.

GENUS *CHIMÆRA*, Linn. This genus has a strong affinity to the *Squali* in general shape, and in the position of the fins, but the gills have only one aperture on each side; yet, on inspecting more accurately, we see that the rays are attached by most of the edges, and that there are really five holes opening into the bottom of a general cavity. A rudiment of an operculum is found in the skin; the jaws are still less complex than in the *Squali*, for the upper jaw is represented only by the vomer, and the palate bones and tympana are merely rudimentary, attached to the sides of the muzzle. Instead of teeth, the mouth is furnished with undivided hard plates, of which four are above and two below. The snout resembles that of the shark, and also has regular ranges of pores. The first dorsal fin is armed with a strong spine, and is placed over the pectorals. The males, as in the *Squali*, are distinguished by the cartilaginous appendages of the ventral fins, divided into three branches, and have two spiny plates before the base of the ventrals. These fish have also on their front a fleshy caruncle, garnished with a group of small prickles. The intestine of this genus is short, and has a spiral valve. The female lays eggs of a large size and coriaceous consistence, flattened, and hairy. The only species is *Chimæra borealis*, or northern elimera. It is found in the Northern Ocean, where it is believed to feed on the numerous Mollusca and Crustacea of that sea. It is rarely taken, because it keeps much in deep water; but it has been occasionally caught among our northern islands, and is sometimes seen of the length of three or four feet. Its head is the thickest part of the body, whence it tapers uniformly to the tail. It is most common on the coasts of Norway, where its eggs are caten, and the oil of its liver is used as a stimulant embrocation. It also occurs in the Mediterranean.

GENUS *CALLORHYNCHUS*, Gronovius. Cuvier separates this from the last genus, to which it was united by Linnæus. It is distinguished by its snout terminating in a fleshy,

¹ In a quarto work published some time ago at Berlin (*Getreue Darstellung, &c.*), containing figures and description of the various animals of use in Therapeutics, there is a *Monograph of the Sturgeons* by Messrs Brandt and Rutzeburgh. See *Annales des Sciences Nat.* for Feb. 1831, p. 223.

Chondropterygii.
Selachii.
flattened process, something in the form of a hoc. The mouth is small, and below the snout. The second dorsal fin commences over the ventrals, and terminates opposite to the commencement of the lower part of the tail. The only known species inhabits the Southern Ocean. See Plate CCCVII. figs. 2 and 3.

ORDER II.—CHONDROPTERYGII WITH FIXED BRANCHIÆ.

Instead of having the gills free at their external edge, in this order we find them fixed all round; and in respiration water is emitted through as many apertures as there are intervals between the rays. Another peculiarity of this order consists in the small cartilaginous arches suspended from the soft parts at the outer edge of the branchiæ.

The Linnaean genera *Squalus* and *Raia* are the principal members of this order; but Cuvier and the later Ichthyologists have subdivided these into several genera, according to marked peculiarities in their anatomical structure.

FAMILY I.—SELACHII, OR PLAGIOTOMI.

The palatal and post-mandibular bones support the teeth, while the bones corresponding to the jaws in other fishes are merely rudimentary. A single bone connects these jaws with the cranium, and represents at the same time tympana, jugal, and temporal bones. The os hyoides is attached to a single pedicle, and, as in ordinary fishes, supports the rays of the gills. The labyrinth is membranous, and included in the cartilaginous substance of the cranium; the sac attached to it does not contain, as in fishes, the porcelainous concretions, but masses that are easily pulverized. The pancreas has the form of a conglomerate gland. The intestinal canal is short; but one part of the tube is furnished internally with a spiral lamina, that seems intended to prevent the too rapid passage of the food.

The Selachii have pectoral and ventral fins; the latter placed behind the abdomen, and on the sides of the anus.

In some respects their sexual intercourse resembles that of Mammifera. The females have well-developed oviducts, which serve the purpose of a matrix in the species whose young are perfected within the body; while in others the ova are covered by a tough and horny envelope, to the formation of which a large gland surrounding each oviduct is subservient. These eggs, especially in the *Squali*, have the form of a parallelogram with long filamentous tendrils at each corner, intended for attaching the egg to Fuci or sub-marine rocks during the maturation of the young included animals. Many of these eggs are found in a female, but only two appear to be perfected at once. In these the fœtus is coiled up, and to its umbilical region is attached a large pyriform bag, of a white colour, by a slender tube. On opening this bag it is found filled with a yellowish, thin liquid, like the yolk of a hen's egg, intended for the nourishment of the fœtus. When the young animal becomes able to collect its own food, the coriaceous egg opens at one end, the creature escapes, and soon the bag, now empty and useless, drops off. The males are provided with two peculiar organs, placed at the inner edge of the ventral fins. Some have supposed that these are *intimately* connected with the generative process; others regard them as mere *holders*, by means of which the female is more closely embraced by the male.

GENUS *SQUALUS*, Linn.; Shark. This forms the first great genus of our present order. The general form is elongated; the tail is thick, with the spinal column continued into the upper lobe; the pectoral fins are of considerable size; the spiracles are on the sides of the neck;

and the eyes on each side of the head. The muzzle is supported by three cartilaginous projections, proceeding from the anterior part of the cranium; and we can easily observe in the skeleton the rudimentary jaws. The scapula is suspended in the flesh behind the gills. Some of the sharks are oviparous, while others are viviparous. Distinct but small branchial rays; there are rudiments of ribs along the spine; and that column is divided into regular vertebræ.

The original genus is numerous, and may be divided as follows.

GENUS *SCYLLIUM*, Cuv. This division is characterised by a short, obtuse muzzle, by nostrils near the mouth, continued in grooves which reach to the edge of the lip, and more or less closed by one or two cuticular lobules. Their teeth have a central point and two lateral prongs. They have spiracles, partly over the pectoral fins. Their dorsal fins are placed far back, the anterior not being before the ventrals. All have an anal fin; and, in some species, its position corresponds to the interval between the two dorsals; the tail is elongated, truncated, not forked.

The most common on our coasts are the following species.

Sq. canicula, L.; greater spotted dog-fish, P. This common and prolific species is very numerous on the northern and western coasts of Britain. The colour of the male is dusky, with numerous distinct small, blackish, spots: the female, of which some naturalists have made another species, is larger than the male, of a more red hue, variegated with deep-brown spots disposed in an ocellated pattern on the sides. The ventral fins of this species have the edge cut obliquely.

Sq. catulus, et *Sq. stellaris*, are also the male and female of another species not uncommon on our coasts. This species differs from the last in size. The spots on its surface are fuller and broader; the ventral fins are more square at the edge.

To this sub-genus belong several other *Squali*, natives of foreign seas. They are distinguished by the position of the anal fin, which is placed behind the second dorsal; the spiracles are remarkably small; the fifth branchial aperture is often concealed in the fourth, and the lobes of the nostrils are usually prolonged into cirrhi.

Among the species are *Sq. pendulatus*; *Sq. Isabella*, Shaw; *Sq. cirrhatus*, Linn.; *Sq. lobatus*; and *Sq. tigrinus*, Lacép., or *Squalus fasciatus* of Bloch.

This last is one of the most beautiful of the order, and has been observed of the length of fourteen or fifteen feet, with a large and blunt head, and tapering body. (See Plate CCCVII. fig. 4.) A few years ago one of them was observed for several hours to follow a Liverpool East Indiaman off Madagascar. It was elegantly transversely banded with alternate whitish and dark brown or blackish fasciæ; and was further variegated by ocellated spots or rings on various parts of its body, which seemed to be about fourteen feet long. Its head appeared to be four and a half feet across; but the thickest part of its body did not seem more than two feet in diameter. It was accompanied by several *pilot-fish*, which often swam before, and returned towards it. Several attempts were made to catch it with large baits of fresh meat, but it never ventured to seize one of them. The lower jaw was distinctly visible whenever it opened its mouth, into which the accompanying fishes seemed to the spectators to enter and to leave at pleasure.

GENUS *SQUALUS* properly so called, Cuv. This group comprehends all those species with a pointed muzzle, under which the nostrils are placed; but the latter parts are not terminated by a groove, nor are they furnished with lobules. The tail has more or less of a forked shape. We may farther subdivide this genus in accordance with

Chondropterygii.
Selachii.

Chondropterygii. Selachii. the presence or absence of apertures behind the eyes, and of an anal fin.

Without Air-Holes, with Anal Fin.

CARCHARIAS, Cuv. This well-known and numerous group have extremely sharp-pointed teeth, often serrated on their edges. Of these, their jaws are armed with several rows, which they have the power of elevating or depressing, and can use with remarkable effect, from the strength of the muscles moving the lower jaw. The first dorsal fin is considerably before the ventrals, and the second is almost opposite to the anal. The posterior branchial apertures are over the pectoral fins.

The best-known species is *Sq. carcharias*, or white shark, the dread of seamen in hot climates, and not unfrequently seen on our own coasts. It is a very large fish, growing, it is said, to more than thirty feet, and often observed to measure from fifteen to twenty-five feet. The teeth are, in full-grown animals, in six rows; those in the upper jaw are nearly isosceles triangles, with sharp, dentated edges; those in the lower jaw have a narrow lancet-shaped point on a broader basis, with smooth-cutting edges. From the position of the mouth in this species, the animal turns on its side on seizing its prey. Its voracity is well known, and it has been seen to leap out of the water in its eagerness to snatch a suspended morsel. The jaws are so powerful as to bite at once through the body of a man. The gullet is very large, and the intestine short. One killed near Marseilles is alleged to have had the entire body of a man, and several fish, in its stomach; and one captured off the island of St Margaretta is even said to have contained the whole body of a horse. This one had the enormous weight of 1500 pounds.

The sailors believe that the pilot-fish, which is so constant an attendant on this species, directs him to his prey; and, by touching his head, warns him against a baited hook. Certain it is, that the pilot-fish have been repeatedly seen clinging to a shark while he was hoisting on deck, and appeared as if distressed on separation from their formidable comrade, who has never been known, in his utmost voracity, to attack his friendly guides. What the instinct is that produces this attachment is unknown; but probably it depends on the pilot (*Naucrates ductor*) obtaining its subsistence from the remains of the shark's prey, as the jackal does from that of the lion.¹

Little of the age or development of this species is ascertained. The female has been known to contain many ova; but only three or four are perfected at a time, and impregnation may take place long before the full growth of the animal. A shark ten feet long has been found to contain forty ova, three or four of which were near maturity.

Sq. vulpes, the thrasher, so called from the inordinate length of his tail, which is almost half the length of the

animal. It is the upper lobe which is thus elongated; and as it has the fin along its under side, it gives the organ some resemblance to a fox's tail. It grows, even in our own seas, to a large size. Pennant measured one thirteen feet, of which the tail was more than six feet. The body is round, the nose short but pointed; the teeth are small, but sharp.

It is this species which is said to attack various Cetacea, which it harasses by dealing them violent strokes with its tail, when they rise to the surface for the purpose of breathing.

Sq. glaucus, the blue shark, is a very bold and voracious fish, not unfrequent on our coasts during the herring season. It grows to ten, or even fourteen feet in length; is of a slaty blue above, and smoother than the rest of the genus. Head large, muzzle very pointed; mouth large; teeth almost triangular, long, sharply pointed; the upper curvilinear, bent outwards; the lower straighter, and all dentated.

The nostrils are long and transverse. Artedi and others have noticed a triangular fossule, with its apex downward, on the lower part of the back.

To this subdivision we must refer the following species: *Sq. ustus*, Dum.; *S. ocellatus*; *Sq. ciliaris*; and several Indian species, described by Russel.

LAMNA, Cuv. This subdivision is distinguished from the last by having all the spiracles *before* the pectoral fins, and by having a projecting pyramidal snout.

Squalus cornubicus, portbeagle shark, is well known in the Mediterranean and British seas, and is formidable on account of its teeth and size. One caught in 1834, on the coast of Caithness, now in the College Museum of Edinburgh, measures eight and a half feet, and is in girth four feet eight inches. Its teeth are upwards of an inch in length, extremely sharp, but not serrated. There are three rows of teeth, of an elongated form, slightly bent outward, and extremely sharp. The nostrils are under the snout, two and a half inches from the eye.² The circumference of the mouth round both jaws is about three feet. This animal is confounded with the white shark, both by seamen and naturalists; but it differs in the form of its teeth, as well as in the other circumstances noticed in the character.

The colour of this species is deep bluish-black, and the skin is smoother than that of most of its congeners.

Sq. monensis, Beaumaris shark, first described by Pennant, was by some considered as a sexual difference only of the last; but this is a mistake. Though similar in many respects, they are quite distinct, as the following characters, taken from a fine specimen caught in Orkney in 1833, will show. The colour of the upper parts a pale leaden gray, the lower parts yellowish white. Skin above covered with very minute granular roughnesses, but less prominent than in the *Squalus catulus* and *Sq.*

¹ We have already discussed the point above alluded to, at greater length, in a preceding portion of the present treatise. See p. 185.

² The following are the more detailed measurements of the specimen above mentioned:—

	Feet.	Inches.		Feet.	Inches.
Extreme length along curvature of back.....	8	3	First dorsal, high, along its edge.....	1	1
Girth at abdomen.....	4	8	perpendicularly.....	0	10
" at spiracles.....	4	0	broad.....	0	9.5
Width of mouth round upper lip.....	1	9	Second dorsal, high.....	0	1.8
round lower lip.....	1	4	broad.....	0	1.5
Length of teeth in upper jaw.....	0	1.5	Pectorals along edge.....	1	5
in lower jaw.....	0	1.2	broad.....	0	9
Length of muzzle from eye.....	0	7.5	Caudal, upper lobe.....	1	10.5
from upper lip.....	0	4.5	lower lobe.....	1	3
Eye in diameter about.....	0	1	spread.....	2	0
Nostrils from eye.....	0	2.5	Ventral at outer edge.....	0	4
Length of spiracles.....	0	9	From pectoral to ventral.....	2	4
From snout to first dorsal.....	3	5.5	Keel near tail.....	0	9.5
From first to second dorsal.....	2	6	Anal fin, broad.....	0	1.5
From second dorsal to caudal.....	0	0			

Chondropterygii.
Selachii.

cunicula. Form of the head obtusely conical, muzzle blunt. The teeth were in three rows, two of which were recumbent, rather than with sharp points and cutting edges, and two small processes at the bases of those of the lower jaw. Numerous nasal pores were perceived on the snout, six of which on each side admitted a slender probe to the depth of three inches; but there were no temporal apertures. A deep sulcus, eight inches long, extended from the ventrals to within two inches of the anal fin. This specimen was a male, with two *holders*, each one foot two inches long, by one and a half in diameter. As this species is rare, we shall give its dimensions.

	Fect.	Inches.
Extreme length along curvature of back.....	7	8
Girth where thickest.....	4	8
Upper lip from muzzle.....	0	5
Mouth along curvature of upper lip.....	1	1
Eye round, in diameter.....	0	1·7
First dorsal, placed a little behind pectoral.....	1	1
Second dorsal, very small, over anal.....	0	2
Anal fin.....	0	2·5
Pectorals along their curved edge.....	1	6
Tail lunated, extent across tips.....	3	0
Upper lobe of ditto.....	1	9
Lower ditto of ditto.....	1	3
Distance between ventral and anal.....	0	10

Both this and the last species have, just above the tail, lateral projections, that in the centre rise into a blunt edge one inch from the general surface in the middle, and decline gradually into the general surface at both ends. These are about eight or nine inches long.

With Air-Holes and Anal Fin.

GALEUS, or *Tope*. These chiefly differ from the true *Squali* in having the temporal apertures. One species is found on our coasts, and is not uncommon in the Firth of Clyde. It seldom exceeds, with us, five or six feet; and there is reason to suspect that the accounts sometimes given of its enormous size arise from confounding it with other sharks. Its skin has a very rank, offensive smell; its colour above is light cinereous, below white; nose long, flattened, and sharp at the point. The muzzle seems translucent toward the end; the nostrils are near the mouth; the first dorsal is placed towards the middle of the back, and is rather large; the second is near the tail; the tail is finned beneath, and ends in a sharp angle above.

MUSTELUS, Hound. This subdivision combines the characters of *Carcharias* and *Galeus*, but it has the temporal apertures and small rounded teeth. The species are of moderate size: Cuvier thinks that Linnæus has confounded two distinct species in his *Sq. mustelus*.

NOTIDANUS, Dry-back. This subdivision is distinguished from *Galeus*, to which it has much resemblance, by the want of the first dorsal fin.

Sq. cinereus has a pointed muzzle, seven large branchial apertures, with a smooth skin compared to most of the family of sharks: the teeth are compressed and sharp; the dorsal is in the middle of the back. Length about three feet.

Sq. griseus. Colour, ash colour above, white below; six wide branchial apertures; teeth large, triangular above, serrated below; snout depressed and rounded; anal fin half way between the ventral and the tail. These two are natives of the Mediterranean. Another species of this subdivision is found in the Indian seas.

SELACHE, Basking Shark. Contains as yet only a single species, which unites to the general form of *Carcharias*, and to the air-holes of *Galeus*, large branchial apertures almost surrounding the neck. It is the gills of this species that have been erroneously described as a sort of

whalebone. The mouth is provided with small teeth; the muzzle projects far beyond it. Nothing has ever been found in its stomach except the remains of Fuci or Algæ, in the numerous instances in which it has been captured in various parts of Scotland. They grow to thirty or thirty-six feet or more, and are fishes of great strength, but are harmless, indolent, and not very sensible to slight wounds. They often lie on the surface of the water, with their large dorsal fin exposed, and permit the approach of boats until the harpoon can be securely fixed in their bodies. They sometimes appear in shoals, but more commonly in pairs; and enter the bays on the western and northern shores of Britain in the months of June and July, but retire from the land on the approach of cold weather. The liver of a full-grown fish has been known to afford eight barrels of fine oil; and on this account the basking shark is considered as a profitable capture.

This is the species to which Sir E. Home erroneously referred the supposed sea-snake, driven on shore in Orkney in 1808; but the enormous length of that animal, the smallness of the vertebræ of the neck, and of its whole head, still preserved in the Museum of the University of Edinburgh, prove that idea to be inconsistent with the fact, and show that singular animal to have been some great species of cartilaginous fish as yet unknown to naturalists,—a species in which we are to look for the prototype of the famous sea-serpent of the Northern Skalds, and the wild legends of the Sagas.

CESTRACION, Cuv. This sub-genus has the temporal apertures, the anal fin, and rounded teeth of *S. mustelus*; but the mouth is terminal, or at the extremity of the pointed muzzle; the middle teeth are small and pointed, those at the angles of the jaw are very broad, and rhomboidal.

The only known species is a native of the Australian seas, the *Sq. Philippi*, which has an elongated lobe on each side of the head.

Species without Anal Fin, but with Air-Holes.

SPINAX, Cuv.; Dog-fish. The *Sq. acanthias*, one of our most common sharks, is the type of this sub-genus. It has all the usual general characters of the *Squali*, but is without an anal fin; it possesses the temporal apertures, and is distinguished by a strong spine placed just before each dorsal. The muzzle of our *piked dog-fish* is long; the teeth in two-rows, small, and cutting, bending from about the middle of the jaw toward the corners of the mouth. The tail is unequal; the upper lobe much the longest, but the lower lobe is *finned* for a considerable space beneath. The colour is of an ash-gray, dashed with brown above and white below: when young, the sides are mottled with whitish spots.

Several foreign species, especially those described by Rafinesque, appear mere varieties of our *Squalus spinax*; indeed this author has multiplied species on very slender authority.

CENTRINA, Cuv. So called from their strong dorsal spines. This subdivision has all the characters of *Spinax*, as far as the spines, want of the anal fin, and possession of temporal apertures; but the body is less elongated, the last dorsal is placed over the ventral, and the tail is short. The best known is the

Sq. centrina, Linn. A species uncommon in our seas, but occurring on various coasts of Europe. (Plate CCCVII. fig. 6.) The mouth is far beneath the snout; the nose is blunt; the head small; in the upper jaw are three rows of teeth, and one only in the lower, all of which are slender and pointed. The dorsal fins are large; the spine in the anterior pointing forward, that in the posterior is directed backwards; both project through the epidermis of the fins.

The *Squalus squamosus* belongs to this division. It is

Chondropterygii. Selachii. allied to *Sq. centrina*, but has conspicuous, ovate, hard, carinated scales.

The skin, like that of most other sharks, is rough, with numerous sharp granular eminences.

SCYMNUS, Cuv. This subdivision has all the characteristics of *Centrina*, except the dorsal spines.

The European species is the *Sq. Americanus* of Broussonet and Shaw. It occurs on the coasts of France, off Cape Breton, which has been mistaken for the transatlantic Cape Breton. It appears to be identical with Risso's *Sq. Nicensis*.

The formidable animal described by O. Fabricius, in his *Fauna Groenlandica*, as *Sq. carcharias*, is now, from the descriptions of Scoresby and others, to be referred to this sub-genus. It is Scoresby's *Sq. borealis*. It wants the anal fin, but has the temporal orifices. It grows to the length of twelve or fourteen feet, and is six or eight in circumference. Scoresby mentions the singular appendages which he invariably found attached to the cornea of this animal. Some have supposed them to be parasitic animals. If so, it is singular that they should be so uniformly in the same position, and of the same size, about one or two inches long, and cleft at their fore extremity into two parts. This shark is peculiarly attracted by a dead whale, out of which it scoops at once masses of blubber as large as a man's head. The sailors believe this species to be blind, from its returning to feed on its favourite morsel, even after having a flensing knife run through its body; but this only shows its fondness for whale blubber,—to which circumstance we may also attribute the comparative safety of Greenland sailors who have fallen into the water when flensing the whale. But, if we may credit Fabricius, when this delectable food is not present, he will attack the slender bark of the Greenlanders.

To this division belong also the *Sq. spinosus* and *Labordii*.

GENUS ZYGÆNA, Cuv. This genus, which has the general form of body and fins of *Carcharias*, is distinguished by the extraordinary form of its head, that has no analogy in nature, except in some of the insect tribe. It is flattened horizontally, truncated in front, and extended laterally into two arms, at the extremity of which are the eyes, giving to the animal the form of a hammer. The mouth is below the centre of this singular head, and the nostrils at its anterior edges on each side. The most common in Europe is the *Sq. zygæna*, or hammer-headed shark, which often attains the length of sixteen or seventeen feet, and is formidable on account of its voracity and strength. It is found also around the West Indies, and in the Indian Ocean, especially at Taheite, where the natives are said, from their dexterity in swimming, to hold it in little dread. It is a very prolific animal. Two kindred species are known: the *Sq. Blochii*, Cuv., which differs in having the nostrils nearer the middle of the head, and its two dorsals much nearer the tail; and *Sq. tiburo*, or heart-headed shark, a much rarer species, which we have received from the coast of Guyana. We here figure *Zygæna Levinii*, a species captured off the south coast of New Holland. Plate CCCVII. fig. 5.

GENUS SQUATINA, Dumer.; Angel-fish. Has the temporal apertures without the anal fin; but its mouth is terminal, and its eyes are both placed on its dorsal surface, in which it differs from all the sharks. The head and body are flattened; the pectoral fins are extremely broad, and project forward to the sides of the head, but are separated from it and the neck by a fissure, in which the branchial apertures are placed; the two dorsals are behind the ventrals, and the tail is equally finned above and below the spinal column.

The best-known species is the *Sq. squatina*, Linn., or angel-shark, which grows to eight or ten feet. It is a bold

and voracious fish; when captured, it bites with great fury; it preys much on flat fish; it has tentacula on its upper lip; its eyes, placed obliquely, give it a sinister look. The English name has been given ironically to this hideous creature, which is by seamen generally termed *devil-fish*.

The teeth are slender, sharp, and dilated at their base; the dorsal fins very small, the pectorals very broad, the ventral large, and enclosing the male organs. The upper lobe of the tail longer than the lower. It is very prolific, fourteen young being sometimes found in its belly; twelve frequently.

To this genus we must also refer the *Sq. aculeatus* of the Mediterranean.

GENUS PRISTIS, Lath.; Saw-fish. This last genus has the general form of the *Squali*, but is more flattened in front, and has the branchial apertures beneath, like the *Rays*. The most peculiar character, however, consists in the great depression and extension of the snout, which has on each side a row of strong teeth or spines, which are trenchant on the fore-side, and mucronated. These spines are not, however, their true teeth. These are lodged in the mouth, and are very small and rounded. But, with their formidable beak, they are said successfully to attack the larger Cetacea. In the foetal *Pristis* the rudiments of these osseous spines are mere tubercles, and the snout is folded up over the head of the embryo. These spines are not, like the teeth of cartilaginous fishes, attached by ligaments to the bones, but are firmly implanted in the bone of the snout.

The best-known species is the *Sq. pristis* of Linn. or *Pristis antiquorum*. It grows to a great size. We have measured snouts more than ten inches in diameter, and four feet seven inches in length, with sixteen or eighteen spines on each side, some of which projected three inches. The animal attains the length of sixteen or eighteen feet. There are other species chiefly distinguished by the number and form of these spines: as *Pristis cuspidatus*,—*Pr. pectinatus*, with numerous slender teeth,—*Pr. microdon*,—*Pr. cirratus*, with alternate long and short teeth,—and *Pr. semi-sagittatus*, a small Indian species, in which the spines are deeply denticulated on the posterior edge.

GENUS RAIÆ (or RAY) of Linnæus. This great genus of the Selachii is very numerous, and the species often grow to a vast size. They are readily recognised by their flattened body, like the *Pleuronectes*, forming a horizontal disk, very broad in proportion to its thickness, in consequence of the body graduating into the enormous pectorals of the animal, which unite in front with the snout, and extend on both sides of the abdomen to the base of the ventral fins. See skeleton of the thorn-back (*R. clavata*), Plate CCCVII. fig. 9. The scapula of these vast pectorals are articulated with the spine just behind the branchial apertures. These apertures, the nostrils, and mouth, are on the ventral surface of the fish; the temporal orifices, and the eyes, are on the dorsal surface. The dorsal fins are usually placed on the tail. These animals are oviparous. Their eggs are coriaceous, square, with long angles. The subdivisions of Cuvier are the following.

GENUS RHINOBATUS, Sch. Distinguished by the length of the snout; connects the sharks and rays. They have a thick and fleshy tail, like *Squali*, with two dorsal and two caudal fins. Their snout and pectorals form a sharp rhomboid. Their teeth are placed in a quincunx arrangement. In some the first dorsal is placed over the ventral fins, in others it is placed farther back. The best known is the Mediterranean *Raia rhinobatus*, which is found four feet in length. The others are, *R. Thouniana* (Plate CCCVII. fig. 7), supposed by Cuvier a variety of that just named, but it has such difference of form as to entitle it to be considered a distinct species; *R. djiddensis*, Forsk.; one de-

Chondropterygii. Selachii.

Chondropterygii. Selachii. scribed by Russel, *R. suttivara*; and one from Brazil, *R. electricus*, Marc, which, as its specific name implies, has been said to possess some of the properties of the *Torpedo*.

GENUS RHINA, Sch. This subdivision has a short, rounded muzzle; in other respects it is like the last named. The species is *R. ancylostomus* of Bloch.

GENUS TORPEDO, Dum. This subdivision is short, and rather fleshy. The body appears a nearly circular disk, the anterior edge being composed of two projections of the muzzle, which stretch sidewise, and unite with the pectorals. The space between these last and the head is entirely filled with the very extraordinary electric apparatus first accurately described by John Hunter. It consists of irregular columns, varying from one and a half inch to one fourth of an inch in length by 0.2 broad. They are irregular hexagons or pentagons, reaching from surface to surface of the fish, and forming (in that dissected by Hunter) an electric organ five inches long, varying in breadth from three to about one and a half inches. Their number on both sides is about 940 in a small fish; but in a large one there were 2364. Their coats are thin and transparent; they are horizontally divided by thin partitions, so numerous that one inch of these columns contained 150 dissepiments filled with fluid. This curious apparatus is supplied with numerous nerves from the eighth pair. The columns are firmly united by cellular substance. When the skin covering this apparatus is touched, the person receives a violent shock at each contact; and it is probable that in this way the species stuns its prey. The animal can give the shock at pleasure; but if often reiterated, the shocks are weakened, until the nervous energy of the fish is recruited by rest. This animal electricity is conducted and intercepted by the same substances that conduct and intercept ordinary artificial electricity. We here figure *T. Bancroftii*. Plate CCCVII. fig. 8.

Several species occur in Europe, which Linnæus confounded together under the title of *Raia torpedo*. We have *Torpedo naske*, distinguished by having no fleshy dentations at the edges of its temporal apertures; its dorsal spots vary from one to five: *Torp. Galvanii* has seven dentations round its air-holes, and is of an uniform brown, sometimes marbled or spotted with darker tints: *Torp. marmorata* is another Mediterranean species, described by Risso. We know several foreign species, such as *Torp. temere* and *Torp. nataltemere* of Russel, *Torp. timlei*? of Bloch.

GENUS RAI, properly so called. Has a rhomboidal body united to a slender tail, which has near its extremity two small dorsals, with, in some instances, a vestige of a caudal fin. The teeth are small, and disposed in a quincunx arrangement on the jaws. Several species inhabit the European seas, some of which are yet indifferently distinguished by naturalists. As articles of diet, some of them are frequently used; and though seldom seen at the tables of the rich, they are by no means despicable food, especially their pectorals.

Raia clavata, or thornback, is a common species, distinguished by the roughness of its back, and the strong osseous oval plates, each furnished with a curved prickle, that are irregularly scattered on both its surfaces. These plates are variable in number, and therefore do not afford any diagnostic character.

Raia rubus, rough ray. There is much confusion among Ichthyologists respecting this and the next species. Cuvier seems to think that the *Batis* of Pennant and *Rubus* of Lacépède are the same; but *Rubus* of Pennant and Willughby is certainly different from the skate, and distinguished from the last by its less pointed nose and the greater length of the tail, and is more thickly studded with small spines, not only on the back, but on the fins and belly, which are equally rough with the back. There are

three rows of large spines down the tail, the surface of which is irregularly beset with small prickles. It is to this species that we confine the name of *R. rubus*. It is less common than *R. batis*, and is a much smaller fish. Found among the Hebrides.

R. batis, the skate. One of the thinnest and broadest of the tribe; but sometimes growing to an immense size, and weighing 200 pounds. The nose, though not very long, is pointed. Sometimes the surface of the back is marbled with dusky and white. Along the tail is one row of spines; a few are irregularly dispersed on the sides of the tail, and the fins of the males have many small spines.

The spring is their season of love; and when coupling, both may be drawn into the boat, though one only has taken the bait. The male *holders* appear to be true organs of penetration, as we have been assured by fishermen. The eggs have the form of coriaceous parallelograms, and are vulgarly with us termed *purses*, which the females begin to cast in May, and continue to perfect and cast till September. This species is often eaten, as well as the thornback, both in the greatest perfection in spring.

R. oxyrinchus, the sharp-nosed ray. We do not agree with Cuvier in confounding this with *R. batis*. The form of the nose is much longer and narrower; the body much smoother than any species we have mentioned, though there are triple rows of small spines along the tail. A single row of small spines runs down its back, and a few are scattered about the eyes. The teeth too, in this species, differ from those of the skate, being bent inward, and less granular. It is not inferior in size to the skate. Indeed specimens are said to have been seen of the weight of 500 pounds.

Some species of this division have a sort of membranous expansion, like a fin elevated in the middle of the back. This has been seen also in rays in other respects resembling the skate; but it is particularly conspicuous in *R. Cuvieri*. To this division likewise belong *R. undulata*, Lacép., *R. fullonica*, *R. marginata*, *R. miraletus*, Rondelet, *R. picta*, *R. alba*, and others.

GENUS TRYGON, Adans. Is characterised by having the tail armed with a spine, finely serrated on both sides; and by the teeth, which are slender, and crowded in a quincunx. Form of the disk obtuse; some have the tail fleshy, but in many it is very slender, and almost destitute of the rudiment of a fin. Most of them have smooth bodies; their caudal spine long—a powerful weapon of offence and of defence, which inflicts severe and dangerous wounds.

R. pastinacea, Linn.; sting ray. Is found on the European coasts. Some have a few prickles on the back; it is tuberculated in others. In some species the lower part of the tail has a broad membrane,—others have a short tail terminated by a fin. The principal species are, *P. tuberculata*; *P. Wolga Tenkée*, Russ.; *P. sephen*, Forsk.; *P. Gesneri*, Cuv.; *P. lynna*, *P. Jamaicensis*, Cuv.; *P. cruciata*, Lacép.; *P. kunsua*, Russ.

GENUS ANACANTHUS, Ehrenb. Has a general resemblance to *Pastinaca*, but is destitute of the spine and anal fin. This sub-genus is formed from the description received of the large *shagreen ray* of the Red Sea, in which the grains are stellate.

R. orbicularis, Bl. belongs to this division.

GENUS MYLIOBATIS, Dumer. This sub-genus has the head projecting beyond the pectorals altogether; and these fins have a greater proportional breadth than in the other rays, which gives these animals no small resemblance to a bird with its wings extended; but their name is derived from the millstone-like form of their broad flat teeth, planted on their jaws like the stones of a pavement: their tail, long, slender, and tapering to a point, is armed, as in *Pastinaca*, with a strong spine, toothed on both sides, and is furnished, just above the spine, with a small dorsal fin. In some instances there are two or more such spines.

Chondropterygii. Selachii.

Chondrop-
terygii.
Cyclos-
tomi.

Raia aquila, or eagle ray, grows to an immense size : it has a projecting parabolic snout : the plates or teeth in the middle of the jaws are in a single row, much broader than long ; but the lateral ones are hexagons in three ranges. The eyes are prominent, the tail very long and slender. It has been known to measure fifteen feet in length, and to weigh 300 lbs. It is said to swim with a slow sailing motion, and when captured vibrates its tail with great activity. It yields much fine oil. Inhabits the Mediterranean, the Atlantic, and Indian Oceans. To this division also we must refer the following species :

R. guttata, Shaw, Plate CCCVII. fig. 10, synonymous with the *Eel-Tenkee* of Russel ; *R. fasciata*, Shaw ; *Myl. bovina*, and *Myl. marginata*, Geoff. ; which last has the snout cleft into two short lobes, and belongs to the sub-genus *Rhinoptera* of Kuhl.

GENUS CEPHALOPTERA, Dum. The last division of the rays is distinguished by the bifurcation of the appendages to the head, derived from the pectorals, which give the species the appearance of being horned. The head is truncated between these projections ; the teeth are less strong than those of *Pastinaca*, and are finely crenulated on the edges ; the tail, spine, and small dorsal fin, resemble those of *Myliobatis*.

The best known is the gigantic *Cephal. giorna* of the Mediterranean, the back of which is blackish, bordered with violet. (Plate CCCVII. fig. 11.) The animals which are mentioned by Shaw as *Raia manatia*, *R. fabroniana*, and *R. Banksiana*, are considered by Cuvier as doubtful species.¹ It is probable that the *R. diabolus* of Willughby, described by Duhamel, and said also to occur at the Azores, may be a distinct species, or perhaps the same as the *Eregodoo-Tenkée* of Russel, which Cuvier is disposed to consider as a species well established. *Ch. massena* of Risso is a Mediterranean species, twelve feet long and twenty-seven in circumference. The female weighs 1250 lbs., the male about 800 lbs. Top of the horns black, the base bluish externally, and white on their inner sides. Of the pair described by Risso, the female was first taken ; and the author adds, that the male continued constantly about the boat for three days, as if bewailing the fate of his companion, and was then found floating dead.

FAMILY II.—CYCLOSTOMI, OR SUCKERS.

The suckers, as far as their skeleton is concerned, are the most imperfect of all vertebrate animals. The bodies of all their vertebræ are traversed by a single tendinous cord, uniformly tapering from head to tail, which almost reduces

the vertebræ to cartilaginous rings, scarcely distinct from one another, and not even cartilaginous through their whole circumference. The body is terminated abruptly in front by a fleshy circular or semicircular mouth, supported on a cartilaginous ring formed by the union of the palatal and maxillary bones. No ribs are distinguishable : there are no solid branchial arches ; but the small branchial rays, scarcely recognisable in *Squalus* and *Raia*, are in them fully developed, and united together into a sort of lattice. The gills, instead of the pectinated form they have in almost all other fishes, exhibit the appearance of little sacs, from the union of each gill with that adjacent. The labyrinth is enclosed in the cranium, the nostrils have only a single aperture, in front of which is a cul-de-sac, mistaken by some authors for a temporal orifice. The intestine is straight and narrow, with a spiral valve.

GENUS PETROMYZON, Linn. This genus is distinguished by seven branchial apertures on each side ; the skin above and below the tail is elevated in a rayless fin. The sub-genera are the following :

GENUS PETROMYZON, Dum. or LAMPREY properly so called. Maxillary ring armed with strong teeth, within which are tubercles, with a hard enamel lining the lips. This ring is suspended by a piece answering to an inter-maxillary bone. The tongue is furnished with two longitudinal ranges of small teeth, and is capable of vigorous motion. The tongue acting like a piston in the circular mouth, is an essential part of the mechanism by which the fish is enabled to attach itself firmly to stones, or to fasten itself to the larger fishes, which it is thus enabled to suck and devour at its leisure. In respiration, the water is carried from the mouth to the gills by a canal under the gullet, and pierced with lateral apertures. The dorsal fin is farther forward than the anus, and a second unites with the tail. The European species are,

P. marinus, the greater lamprey, which grows to the length of more than three feet. (Plate CCCVII. fig. 12.) It is considered as a delicate food, and is caught as it ascends rivers in the end of winter and spring.² Colour yellowish, marbled with brown. First dorsal fin very distinct from the second. This fish is common in the Severn, and in the mouths of many European rivers. Its supposed *hermaphroditism* is mentioned by Sir Everard Home.³

P. fluviatilis, the lampern, or nine-eyed eel.⁴ Length from twelve to eighteen inches ; olive back, silvery below ; first dorsal distinct from the second. Two thick teeth, separate, in the top of the maxillary ring. Ascends rivers from the sea ; swarms in the Thames, Severn, and Dee. Vast quantities taken in England are sold to the Dutch for the turbot fishery. It abounds in the rivers on the southern side of

Chondrop-
terygii.
Cyclos-
tomi.

¹ There is no doubt, however, that one or other of those names refers to an existing though obscurely known species, of enormous size. A specimen of the *Banksian ray* is said to have been found on the coast of Barbadoes, of such a vast weight that seven yoke of oxen were required to draw it. A figure of the *Ceph. manatium* was sent to Lacépède, the original of which was alleged to be nearly twenty feet long. "It seems that it is to this species we may refer what Barrère and other travellers have said of the enormous rays of the American and equinoctial seas, which spring above the surface of the water, and splash it to an immense distance on falling into it. Levaillant, in his second voyage to Africa, speaks of having seen one, the smallest of three, which swam round about the vessel, about twenty-five feet long and more than thirty wide ; and Sonnini speaks of one which appeared to him larger and wider than the ship in which he was sailing." "Colonel Hamilton Smith once witnessed the destruction of a soldier by one of these Cephalopteri, off Trinidad. It was supposed that the soldier, being a good swimmer, was attempting to desert from the ship, which lay at anchor in the entrance of the Bocca del Toro. The circumstance occurred soon after daylight ; and the man, being alarmed by the call of a sailor in the main cross-trees, endeavoured to return to the vessel ; but the monster threw one of his fins over him, and carried him down. The colonel is positive as to this fish being a Cephalopterus." (Griffith's *Animal Kingdom*, vol. x. p. 653.)

² The death of Henry I. was attributed to a too plentiful meal of lampreys. They seem, however, to have continued in high esteem in spite of that "untoward event ;"—at least we find Henry IV. granting protection to such ships as brought over lampreys for his royal consort's table ; and his successor issued a warrant to William of Nantes, for supplying himself and his army with these fishes, wherever they might happen to march. (Rymer, ix. 544, as quoted by Pennant.)

³ Phil. Trans. 1815, 266.

⁴ "Whether," says Sir Thomas Brown, "Lampries have nine eyes, as is received, we durst refer it unto Polyphemus himself, who had but one to judge it ; an error concerning eyes, occasioned by the error of eyes, deduced from the appearance of divers cavities or holes on either side, which some call eyes that carelessly behold them ; and is not only refutable by experience, but also repugnant unto reason." (*Pseudodoxia Epidemica*.)

Conclusion, the Baltic. Both these animals are very tenacious of life, and will live many days out of water.

P. planeri. About ten inches long; greatly resembles the preceding; but the two dorsal fins are united. It is also an European river fish.

The other species described by Shaw appear to be but mere varieties of the above.

GENUS MYXINE, Linn. This genus is properly separated from the lampreys, to which, however, it has much resemblance. It is distinguished by having only two spiracles, and by wanting eyes. The species best known, *Myxine glutinosa*, Linn., or glutinous hag, was classed by Linnæus with the Vermes; but its real place is among chondropterygian fishes. The mouth is a membranous ring, with a single tooth on its superior part; while the strong dentations of the tongue are arranged in two rows on each side, so as to give to these animals the appearance of having lateral jaws, like insects or nereides; but the rest of their structure corresponds with *Petromyzon*, and their tongue in particular performs the office of a piston in exhausting the mouth, so as to enable them to adhere to other bodies, like the lamprey. The lips are furnished with eight cirrhi, and above is an aperture communicating with the mouth; the body is nearly cylindrical, and terminates in a fin which surrounds the tail. The intestine is simple, wide, and straight, as viewed externally; but it is plaited within: the liver has two lobes: the eggs grow to a considerable size. When taken and confined in a large glass jar, a single fish will pour so much mucus from its lateral pores as to give the water the appearance of jelly.

Three species are known, which Cuvier makes the types of a corresponding number of sub-genera, as follows:

1st, *HEPTATREMUS*, Dumer. With seven branchial apertures, as in the lamprey. This animal is the *M. Dombeyi*, found on the coast of South America by Dombey. It has a rounded head; the teeth are sharp, and arranged in two rows, respectively of fourteen and twenty-two, and with one longer than the rest in the upper part of the mouth; tail rounded at the extremity, and terminated by a very shallow fin.

2d, *GASTROBRANCHUS*, Bloch. The intervals of the branchial rays open into a common canal for each side, and these two canals terminate in two apertures under the heart of the animal, about one third of its length from the head.

The only known species is the European *Myxine glutinosa*, Linn. On the Yorkshire coast the fishermen occasionally find that it has entered the mouths of fish on the hooks of the long lines, and devoured the flesh, leaving only the skin and bones. They often catch it in the fish thus emptied, and term it the *sea-hag*. It grows to the length of six or eight inches.

3d, *AMMOCTES*, Dumer. Is destitute of a real skeleton; body cylindrical, with numerous annular lines around it, that give it much the appearance of a worm. It lives in the mud of rivers. Mouth cirrhated, toothless, lobated below, and incapable of adhering by suction to other bodies; fins very shallow; tail sharp at the tip; no tracheal tube, as in the rest, but the gills receive water from the œsophagus. The only species is *P. branchialis*, Shaw, the *Pride* of Pennant, which grows to six or eight inches long, and is as thick as a goose-quill. It inhabits the rivers of Oxfordshire, and occurs in various parts of the European continent.

We have now brought our exposition of the modern system of Ichthyology to a close. The subjects of which it treats are of deep and sustaining interest, in a philosophical point of view, and of the highest and most immediate importance when considered in relation to the economical advantages derivable by the human race. We

have endeavoured to combine with the precise and technical expression of the generic and other characters such miscellaneous information as could be collected from authentic sources, with a view to render the subject more palatable to the general reader;—and if any great deficiency in that department is observable, we hope it may in some measure be attributed to the nature of this branch of natural history, the objects of which inhabiting another element from ourselves, have thus their on-goings too often veiled from mortal sight by a “world of waters,”—which no eye can pierce but the eye of HIM who called the light out of darkness, and who created the “heavens and the earth, the sea, and all that in them is.”

We shall conclude with a brief allusion to a subject of the highest interest to the naturalist,—one to which we believe no reference has been made in the introductory portion of the present treatise, and which, we regret, our now exhausted space must prevent us from exhibiting at greater length,—we mean the *geographical distribution* of fishes. Our knowledge of the laws which regulate that distribution is meagre in the extreme; in other words, the facts concerning their true localities are few, and have never been properly generalised. From the immeasurable extent and continuous nature of the fluid which they inhabit, they are supplied by nature with greater facilities of dispersion than most other animals; and the greater equality of the temperature of water, compared with that of earth or air, admits in several instances of the same species inhabiting almost every latitude from pole to pole. Those races especially, which, travelling together in vast shoals, speedily consume the natural food which each particular spot affords, are obliged, like the pastoral tribes of old, or the woodland hunters of America, to remove from place to place in search of additional supplies; and thus the species acquires a more widely extended distribution. It is thus that the cod and herring are spread over the whole extent of the Northern Ocean, and in undiminished numbers, notwithstanding the war of extermination which man and other voracious animals appear to wage against them. Those species which lead a solitary, and, as it may be called, a stationary life, are frequently confined within very narrow limits. The *Chaetodons*, for example, which delight in rocky coasts covered with madrepores, attach themselves to the torrid zone, which produces so abundantly those magnificent ornaments of the sea. But though thus confined to particular spots, from which the individuals of the species seldom wander, the species itself may be said to be repeated again in different regions, separated from each other by almost insurmountable obstacles. Thus many of what may be termed stationary species are found identically the same along the coasts of Brazil, in the Arabian Gulf, and over the multiplied shores of Polynesia. It has hence been concluded, that such species, incapable of colonizing themselves by leaving their accustomed shores, and hazarding a journey across unknown oceans, have either been created in more places than one, or have been enabled to transport themselves by means different from any of those that are now available in the ordinary course of nature.

If the natural means by which the more powerful species inhabiting the saline waters of the ocean have spread themselves from clime to clime, be to a certain extent within the reach of our comprehension, it is otherwise with those peculiar to rivers, and the waters of inland lakes. How these have contrived to migrate from one region to another, and to people with identical species the depth of far-removed and solitary waters, separated from each other by chains of lofty mountains, or wide extended wastes of desert sand, is a problem which, in the present state of our knowledge, we seek in vain to solve. It may indeed at times happen that spawn or ova are carried by water-fowl

Index. from one great central reservoir to another, and thus the rivers of half a continent may be put in possession of species unknown before ;—but this supposition scarcely suf-

fices to account for the general diffusion of certain species, and still less for the narrow restriction of others equally exposed to the chances of that aerial flight.¹ (T.²) Index.

INDEX.

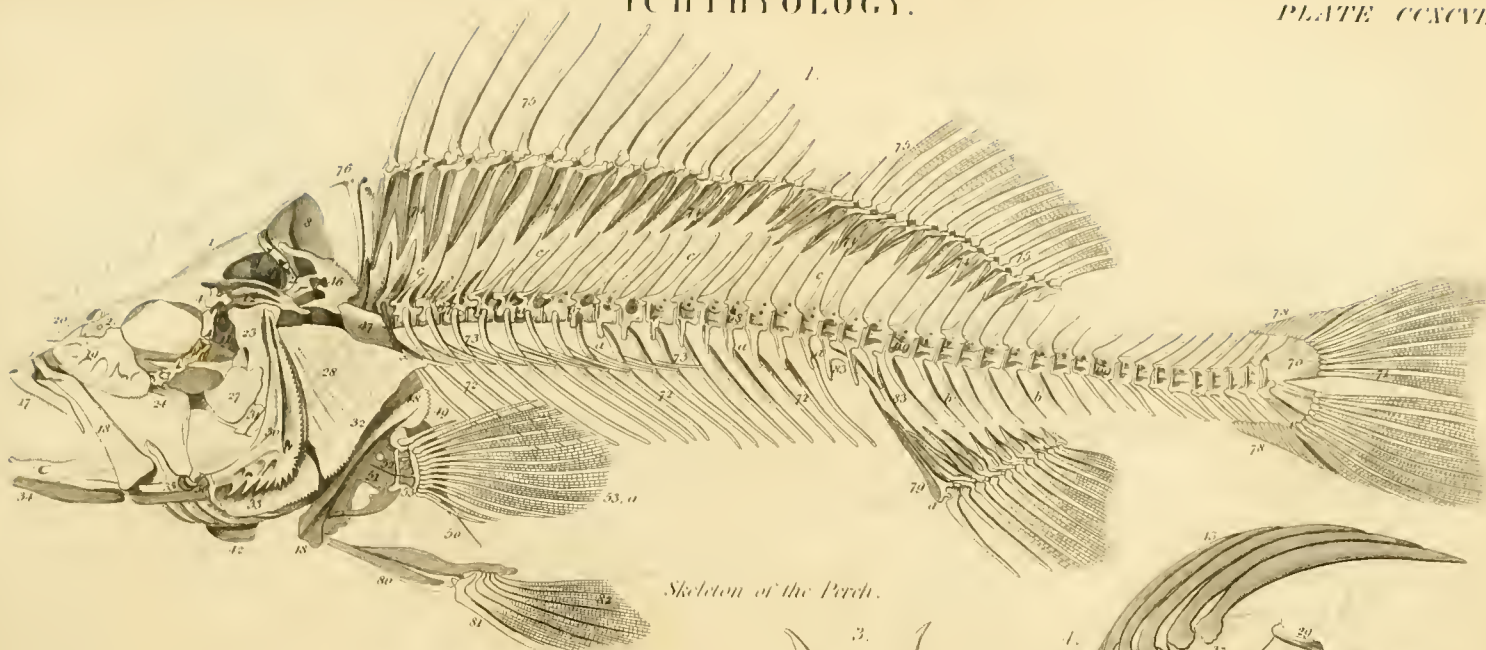
	Page.		Page.		Page.
Abramis.....	198	Blennius.....	192	Chelmon.....	178
ACANTHOPTERY-		<i>Blenny</i>	192	Chimæra.....	230
GII.....	166	<i>viviparous</i>	193	Chirocentrus.....	216
Acanthurus.....	190	Blepharis.....	186	Chironectes.....	195
Acerina.....	169	<i>Bonito</i>	198	Chironemus.....	169
Achirus.....	221	Boops.....	178	Chirus.....	194
Acipenser.....	230	<i>Braize</i>	177	CHONDROPTERY-	
Ageneiosi.....	202	Brama.....	180	GII.....	229-231
Agriopus.....	174	<i>Bream</i>	177	WITH FREE BRAN-	
Alepocephalus.....	200	<i>common</i>	198	CHLÆ.....	230
Aleuteræ.....	229	<i>black</i>	177	WITH FIXED BRAN-	
Alosa.....	215	<i>little</i>	198	CHLÆ.....	231
Ambassis.....	168	<i>sea</i>	177	Chorenemus.....	186
Amia.....	216	<i>Spanish</i>	177	Chromis.....	196
Ammodytes.....	227	<i>Brill</i>	220	Chrysophris.....	177
Ammocætes.....	237	<i>Brochet</i>	168	Cirrhibarbus.....	192
Ampliiprion.....	176	Brosenius.....	219	Cirrhitæ.....	169
Amphisile.....	197	Brotula.....	219	Citharinus.....	213
Anabas.....	190	BUCCÆ LORICATÆ.....	172	Clepticus.....	196
Anableps.....	199	<i>Bull-head</i>	173	Clinus.....	192
Anacanthus.....	235	<i>Buffalo-fish</i>	179	Clupea.....	214
Anarrhichas.....	193	Butirinus.....	216	CLUPIDÆ.....	214
Anastomus.....	212			<i>Coal-fish</i>	218
<i>Anchor</i>	216	Callionymus.....	194	Cobitis.....	199
Ancylodon.....	176	Callorhynchus.....	230	<i>Cod</i>	217
<i>Angel-fish</i>	234	Cantharis.....	177	Colisa.....	190
Anguilla.....	223	Capros.....	189	Comephora.....	194
ANGUILLIFORMES.....	223	Caranx.....	186	Coregonus.....	211
Anthius.....	168	Carapus.....	226	Coricus.....	196
Apistus.....	174	Carcharias.....	232	Corvina.....	175
Apogon.....	168	<i>Carp</i>	197	Coryphæna.....	186
Argentina.....	212	<i>common</i>	197	Cottus.....	173
Argyreus.....	186	<i>golden</i>	198	Crenilabrus.....	195
Aspidophorus.....	174	CARTILAGINOUS		Curimata.....	212
Aspredo.....	203	FISHES.....	229	Cybium.....	183
Aspro.....	168	Cataphractus.....	203	Cychla.....	196
Astrodermus.....	187	Catastomus.....	198	Cyclopterus.....	221
Atherina.....	192	<i>Cat-fish</i>	202	CYCLOSTOMI.....	236
Aulopus.....	213	Centrarchus.....	169	CYPRINIDÆ.....	197
Aulostoma.....	197	Centrina.....	233	Cyprinodon.....	199
Auxis.....	183	Centriscus.....	197	Cyprinus.....	197
Auxinurus.....	190	Centrolophus.....	187	<i>Dab</i>	220
		Centropomus.....	168	Dactylopterus.....	173
Bagrus.....	202	Centropristis.....	169	Dascyllus.....	176
Balistes.....	229	Cephaloptera.....	236	Datnia.....	169
<i>Baloon-fish</i>	228	Cepola.....	189	<i>Deal-fish</i>	189
<i>Barbel</i>	198	Cestracion.....	233	Dentex.....	177
Barbus.....	198	Chætodon.....	178	<i>Devil-fish</i>	234
Batrachus.....	195	Chalceus.....	212	Diagramma.....	176
<i>Becker</i>	177	<i>Char</i>	208	Diodon.....	228
Belone.....	200	Characinus.....	212	Diploprion.....	168
<i>Benticles</i>	175	Chatæssus.....	215	Dipterodon.....	180
<i>Bergyll</i>	174	Chauliodus.....	200	DISCOBOLI.....	221
Beryx.....	170	Cheilinus.....	195	<i>Dog-fish</i>	233
<i>Bleak</i>	199	Cheilodactylus.....	176		
				<i>Dolphin</i>	187
				Doras.....	202
				<i>Dorse</i>	218
				<i>Dory</i>	188
				<i>Dragonet</i>	194
				<i>gemmeous</i>	194
				<i>sordid</i>	194
				<i>Drums</i>	176
				Dules.....	169
				Echeneis.....	222
				<i>Eel</i>	223
				<i>common</i>	223
				<i>conger</i>	224
				<i>electric</i>	225
				<i>sand</i>	227
				<i>Egyptian herring</i>	201
				Elacate.....	186
				Eleotris.....	194
				Elops.....	196-216
				<i>Emperor of Japan</i>	179
				Enchelyopus.....	226
				Engraulis.....	216
				Enoplosus.....	168
				Ephippus.....	179
				Eques.....	176
				Equula.....	189
				Erythrinus.....	216
				ESOCIDÆ.....	199
				Esox.....	199
				Etelis.....	168
				Exocetus.....	201
				<i>Fan-fish</i>	184
				<i>Father lasher</i>	174
				<i>Fishes</i>	
				Definition of.....	151
				Form and character of.....	153
				Osteology of.....	154
				Muscles and motions of.....	156
				Nervous system of.....	157
				Senses of.....	157
				Nutrition, manduca-	
				tion, and degluti-	
				tion of.....	159
				Circulating system of.....	160
				Respiration of.....	161
				Swimming bladder of.....	161
				Rank in the animal	
				kingdom.....	162
				Classification of.....	163
				Tabular view of the	
				Cuvierian system.....	165
				Fistularia.....	196
				FISTULARIDÆ.....	196

¹ Consult M. Gaimard's *Mémoire sur la Distribution Géographique des Poissons*; an Essay on Geography considered in relation to natural history, in the seventh volume of the *Diction. Classique d'Hist. Nat.*; and our *Illustrations of Zoology*, letter-press preceding plate xx.

² The author of the preceding treatise has to acknowledge his obligations to Sir William Jardine, Bart., for the use of his notes on the Salmonidæ,—to Professor Traill, for assistance in relation to the Apodal Malacopterygian, and Chondropterygian tribes,—and to Dr Allan Thomson, for his aid in drawing up the history of the Clupidæ, and of the Sub-brachian Malacopterygians.

Index.	Page.		Page.		Page.		Page.	Index.
<i>Flat-fish</i>	219	<i>King-fish</i>	189	Monochirus.....	221	Piabuscus.....	212	
<i>Flounder</i>	220	<i>King of the herrings</i>	189	Mormyrus.....	201	<i>Pike</i>	200	
<i>Flying-fish</i>	173	<i>Kitt</i>	220	Morrihua.....	217	<i>Pilchard</i>	215	
<i>Mediterranean</i>	173	Kurtus.....	188	Motella.....	219	<i>Pilot-fish</i>	185	
<i>Oceanic</i>	201			<i>Mountsbay angler</i>	195	Pimelodi.....	202	
Fundulus.....	199	Labco.....	198	MUGILIDÆ.....	191	Pimelepterus.....	179	
GADIDÆ.....	217	Labrax.....	167	<i>Mullet</i>	172	Pinguipes.....	171	
Gadus.....	217	LABRIDÆ.....	195	<i>red</i>	172	PLAGIOTOMI.....	231	
Galeus.....	233	Labrus.....	195	<i>striped</i>	172	<i>Plaice</i>	220	
Gallichtys.....	186	Labyrinthiform Pharyngeals.....	190	<i>gray</i>	191	Platax.....	179	
Galaxias.....	200	Lamna.....	232	Mullus.....	172	Platessa.....	219	
<i>Gar-fish</i>	200	Lampern.....	236	Muræna.....	224	Platycephalus.....	174	
Gasteropelecus.....	212	<i>Lamprey</i>	236	Mustelus.....	233	Platypteron.....	194	
Gasterosteus.....	175	Lampris.....	189	Myletes.....	212	PLECTOGNATHI.....	228	
Gastrobranchus.....	237	Lampugus.....	187	Myliobatis.....	235	Plectropoma.....	169	
Gempylus.....	183	<i>Launce, common</i>	227	Myripristis.....	170	Plesiops.....	196	
<i>Gherad-el-bahir</i>	174	Latcs.....	168	Myxine.....	137	PLEURONECTIDÆ.....	219	
<i>Gilt-head</i>	177	Latelus.....	176	Myxodes.....	192	Plotosus.....	203	
Glyphisodon.....	176	Lebias.....	199	Naseus.....	190	<i>Podley</i>	218	
<i>Gobies</i>	193	Lepadogaster.....	221	Nauclerus.....	186	Pœcilia.....	199	
Gobiesox.....	221	Lepidopus.....	183	Naucrates.....	185	Pogonias.....	176	
Gobio.....	198	Lepisosteus.....	216	Niphon.....	168	<i>Pogge</i>	174	
Gobioidæ.....	192	Leptocephalus.....	226	Nomeus.....	186	<i>Pollock</i>	218	
Gobioides.....	193	Leuciscus.....	198	<i>Norway haddock</i>	174	Polyacanthus.....	190	
Gobius.....	193	Lichia.....	186	Notocanthus.....	186	Polynemus.....	171	
Gonorrhynchus.....	199	<i>Ling</i>	218	Notidanus.....	233	Polyodon.....	230	
Grammistes.....	168	Liparis.....	222	Notopterus.....	215	Polyprion.....	169	
<i>Grayling</i>	210	<i>Loach</i>	199	Odontognathus.....	215	Polypterus.....	217	
Gristes.....	169	Lobotes.....	176	<i>Old wife</i>	195	Pomatomus.....	168	
<i>Gudgeon</i>	198	Lophotes.....	189	Olistus.....	186	Pomotis.....	169	
<i>Gunnel, common</i>	193	Lophius.....	194	Ophicephalus.....	190	Porthoneus.....	186	
Gunellus.....	192	LOPHOBANCHII.....	227	Ophidium.....	226	<i>Pomfret, black</i>	188	
<i>Gurnards</i>	173	Loricaria.....	203	Opistognathus.....	193	Pomocentrus.....	176	
Gymnarchus.....	226	Lota.....	218	Ophisurus.....	224	Premnas.....	176	
Gymnetrus.....	189	Lucio-perca.....	168	Orthogoriscus.....	228	Priacanthus.....	169	
Gymnodontes.....	228	<i>Lump-fish</i>	221	Osmerus.....	210	Prionites.....	173	
Gymnotus.....	225	Lumpus.....	221	Osphronemus.....	190	Priodon.....	190	
		Luvarus.....	188	OSSEOUS FISHES.....	166	Pristigaster.....	215	
<i>Haddock</i>	208			Osteoglossum.....	216	Pristipoma.....	176	
Hamulon.....	176	<i>Mackerel</i>	180	Ostracion.....	229	Pristis.....	234	
<i>Hake</i>	218	Macrourus.....	219	Otolithus.....	176	Psenes.....	186	
<i>Harvest-fish</i>	188	Macropodus.....	190	Pagellus.....	177	Psettus.....	179	
Heliascs.....	176	<i>Maigre</i>	175	Pagrus.....	177	Pteraclis.....	187	
Helostoma.....	190	Malacanthus.....	196	<i>Par</i>	208	Pterois.....	174	
Helotes.....	169	Makaira.....	184	<i>Parrot-fish</i>	196			
Hemilepidotus.....	174	Malapterurus.....	203	<i>Peche madame</i>	170	Raia.....	234	
Hemiramphus.....	201	MALACOPTERYGII.....		PECTORALES PEDICULATI.....	194	Raniceps.....	219	
Hemitripterus.....	174	ABDOMINALES.....	197	Pegasus.....	227	Ray.....	235	
Henochius.....	178	MALACOPTERYGII.....		Pelamys.....	183	<i>Remora</i>	222	
Heptatremus.....	237	APODES.....	223	Pelates.....	169	Rhina.....	235	
<i>Herring</i>	214	MALACOPTERYGII.....		Pelorus.....	174	Rhynchobdella.....	186	
Heterobranchus.....	202	SUB-BRACHIATI.....	217	Pentaceros.....	169	Rhinobatus.....	234	
Hippocampus.....	227	<i>Malarmat</i>	173	Perca.....	167	Rhombus.....	188-220	
Hippoglossus.....	220	Mallotus.....	210	<i>Perch</i>	167	Roach.....	199	
Histiophorus.....	184	Malthe.....	195	<i>common</i>	167	Rypticus.....	169	
<i>Holbut</i>	220	<i>Mango-fish</i>	171	<i>sea</i>	167	<i>Ruffe</i>	169	
Holocanthus.....	179	Mastacomblus.....	186	<i>black</i>	187			
Holocentrum.....	170	Megalops.....	216	Percis.....	171	Salanx.....	200	
Huro.....	168	Mene.....	189	Percopis.....	171	Salarias.....	192	
Hydrocyon.....	213	MENIDÆ.....	178	Periophthalmus.....	194	Samo.....	204	
Hynnis.....	186	Merluccius.....	218	Peristedion.....	173	Salmon.....	204	
Hydon.....	216	Merrus.....	169	Petromyzon.....	236	SALMONIDÆ.....	203	
Hypostoma.....	203	Mesoprion.....	169	Phycis.....	219	<i>Sand-smelt</i>	192	
		Microstoma.....	200			<i>Sand-eel</i>	227	
Ichthyology.....	151	<i>Miller's thumb</i>	173			Sargus.....	176	
Definition of.....	151	<i>Minnow</i>	199			Saurus.....	213	
Historical sketch of.....	151	Molinesia.....	199			<i>Saw-fish</i>	234	
<i>Ikan-umpit</i>	180	Monocanthus.....	229			<i>Scad</i>	186	
Johnius.....	176	Monocentris.....	174			<i>Scampirro</i>	182	
						Scarus.....	196	

Ichthyophagi Ickenild Street.	Sciæna.....	Page. 175	Sillago.....	Page. 170	Synanceia.....	Page. 174	Trigla.....	Page. 173	Iconium Iconoclas- tes.
	SCIÆNIDÆ.....	175	Sillock.....	218	Synbranchus.....	225	Triodon.....	229	
	Schelley.....	211	SILURIDÆ.....	202	Syngnathus.....	227	Trout.....	206	
	Schilbus.....	202	Silurus.....	202	Synodontis.....	202	<i>bull</i>	206	
	SCLERODERMI.....	229	<i>electric</i>	203			<i>sea</i>	206	
	Scolopsides.....	176	Skate.....	235	TÆNIOIDÆ.....	189	<i>white</i>	206	
	Scomber.....	180	Shankarbauw.....	179	Tafel-risch.....	170	<i>salmon</i>	206	
	Scomber-esox.....	200	Skip-jack.....	186	Taurichthys.....	179	<i>common</i>	207	
	SCOMBERIDÆ.....	180	Smoults.....	208	Temnodon.....	186	Trumpet-fish.....	197	
	Scopeles.....	213	Solenostoma.....	227	Tench.....	198	Trunk-fish.....	229	
	Scorpæna.....	174	Solea.....	221	Tenioides.....	193	Trigon.....	235	
	Scorpion.....	174	Sole.....	221	Tetraodon.....	228	Tunny.....	182	
	Scyllium.....	231	Sorcerer-fish.....	174	Tetragonopterus.....	212	Turbot.....	220	
	Scymnus.....	234	SPARIDÆ.....	176	Tetragonurus.....	192			
	Scyris.....	186	Spiralin.....	210	Tetrapterus.....	184	Umbrina.....	176	
	Sea-cat.....	193	Sphagebranchus.....	225	Therapon.....	169	Upeneus.....	172	
	Sea-devil.....	174	Sphyræna.....	171	THEUTIDÆ.....	189	Uranoscopus.....	171	
	Sea-wolf.....	193	Spinax.....	233	Thorn-back.....	235			
	Sea-horse.....	227	Spirobranchus.....	190	Thresher.....	232	Vendace.....	211	
	Sea-hag.....	237	Sprat.....	215	Thryssa.....	216	Vlagman.....	179	
	Sebastes.....	174	Squalus.....	231	Thymallus.....	210	Vomer.....	186	
	Selache.....	233	SQUAMMIPENNES.....	178	Thynnus.....	182			
	SELACHII.....	231	Squatina.....	234	Thysites.....	183	Weever.....	170	
	Seriola.....	186	Sterlet.....	230	Tinca.....	198	Whiff.....	220	
	Serranus.....	168	Sternarchus.....	226	Tope.....	233	White-bait.....	215	
	Serrasalmus.....	212	Sternoptyx.....	213	Torpedo.....	235	Whiting.....	218	
	Seserinus.....	188	Stickle-back.....	175	Torsk, Scotch.....	219	Whitling.....	206	
	Shark.....	231	Stomias.....	200	Toxotes.....	180	Wrasse.....	195	
	<i>white</i>	232	Stromateus.....	188	Trachichtys.....	170			
	<i>blue</i>	232	Sturgeon.....	230	Trachinotus.....	186	Xiphias.....	183	
	<i>portbeagle</i>	232	STURIONES.....	230	Trachinus.....	170	Xirichthys.....	196	
	<i>Beaumaris</i>	232	Sucking-fish.....	222	Triacanthus.....	229			
	<i>basking</i>	233	Sudis.....	216	Trichiurus.....	183	Zanclus.....	179	
	<i>hammer-headed</i>	234	Sun-fish.....	169-228	Trichodon.....	170	Zeus.....	188	
	Sharmuth.....	203	SUCKERS.....	236	Trichonotus.....	194	Zoarchus.....	193	
	Sheeps-head.....	177	Sword-fish.....	184	Trichopus.....	190	Zygæna.....	234	
	Siganus.....	189							



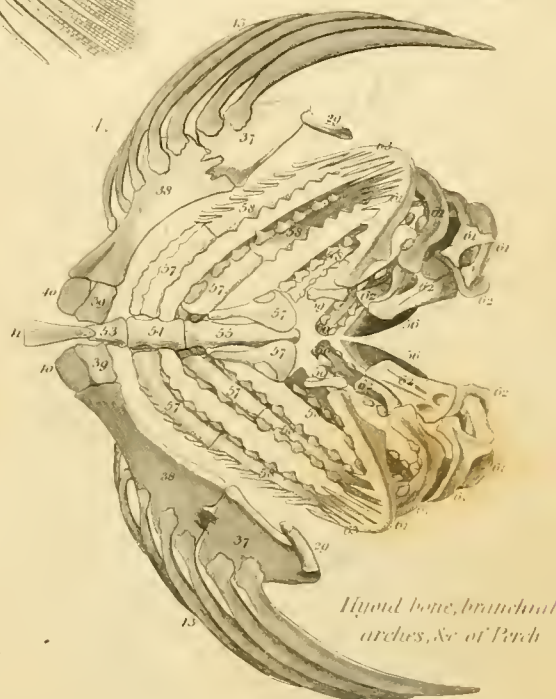
Skeleton of the Perch.



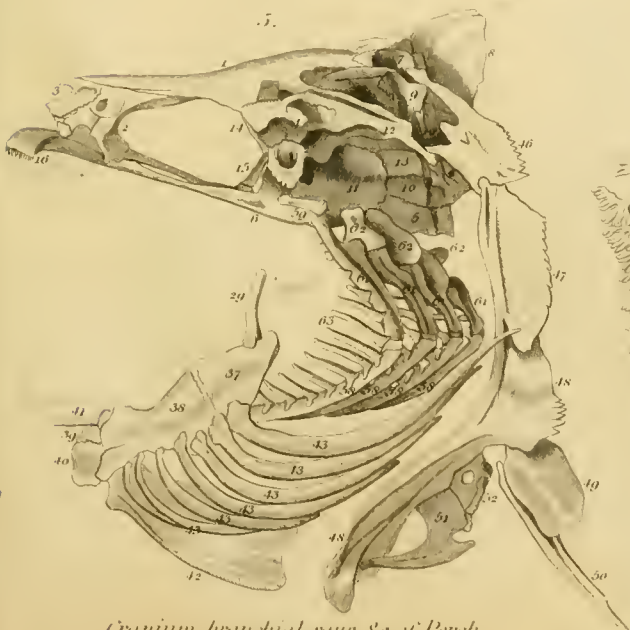
Cranium, &c. of Perch.



*Air-bladder of
Corvina trispinosa.*



*Hyoid bone, branchial
arches, &c. of Perch*



Cranium, branchial rays, &c. of Perch.



*Air bladder of
Johnius lobatus.*



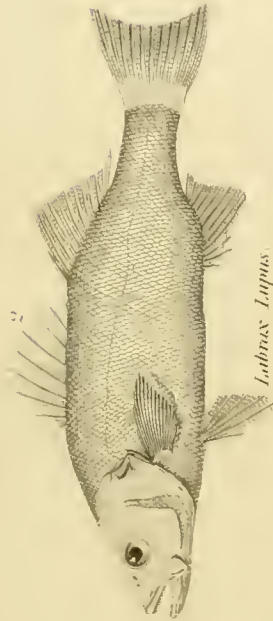
Air bladder of Pogonius chromis.



*Air bladder of
Johnius catula.*



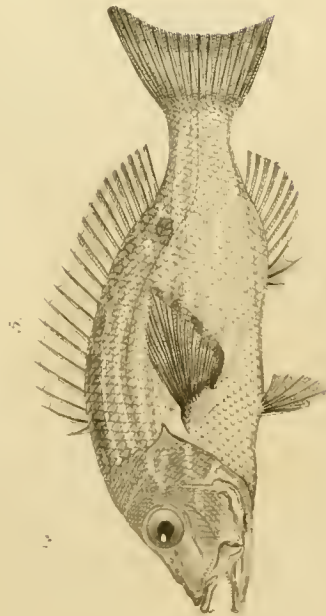
Percu flaviventris



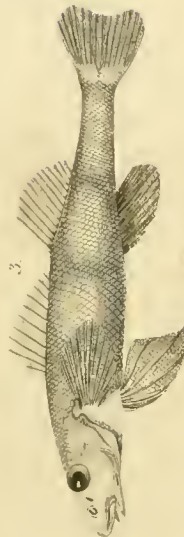
Labrus lupus



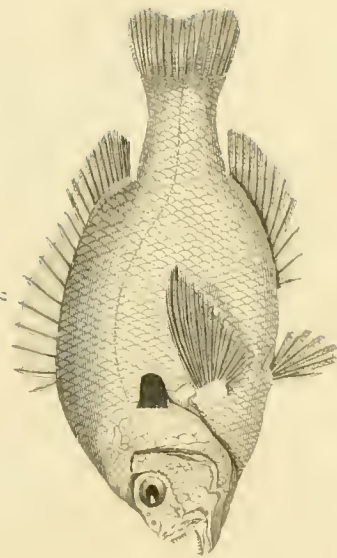
Sternaus olivaceus



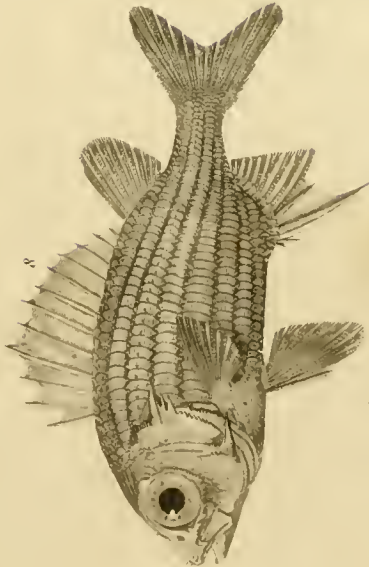
Mesoprius unimaculatus



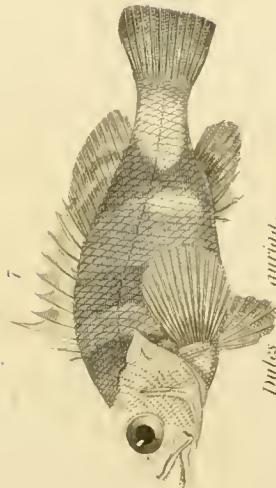
Aspro vulgaris



Pomolus vulgaris



Halocentrum hastatum



Pules auriga



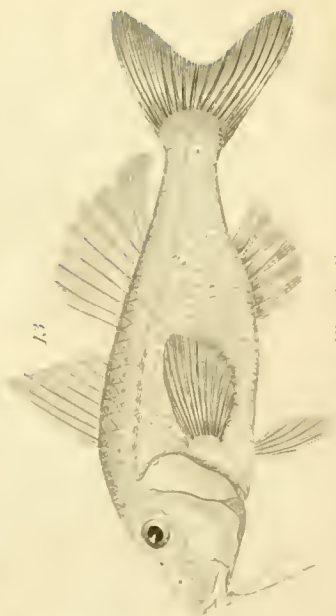
Trunoscopus inermis



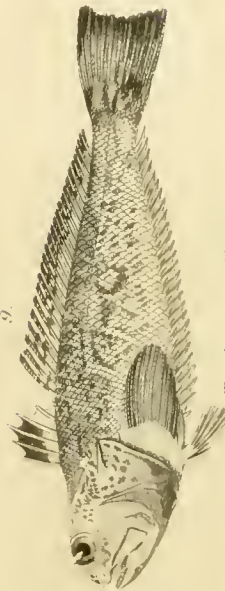
Polygonus quadrifilis



Mullus barbatus



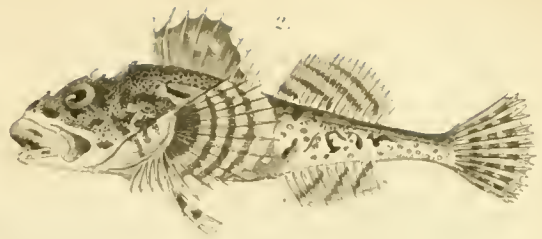
Upeneus Vlamingtoni



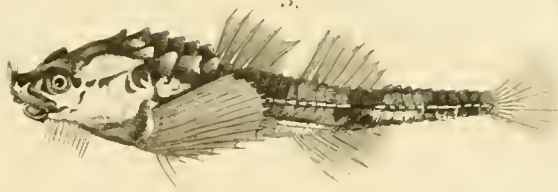
Trachinus radiatus



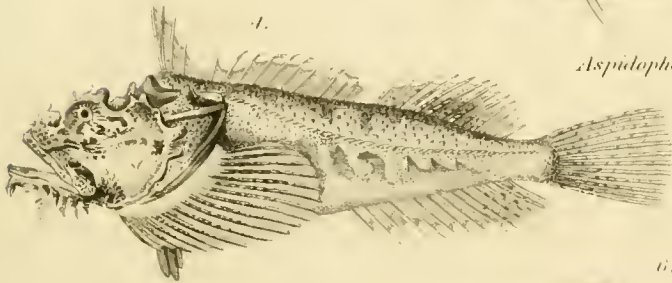
Trigla gurnardus.



Cottus scorpius.



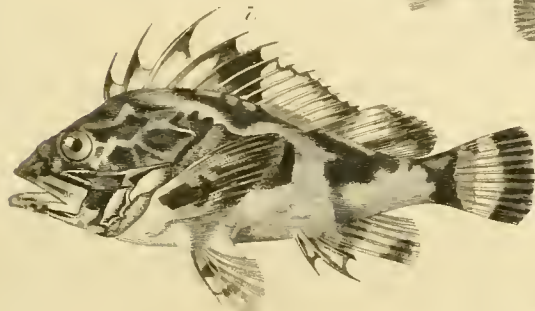
Aspidophorus cataphractus.



Hemitripterus Americanus.



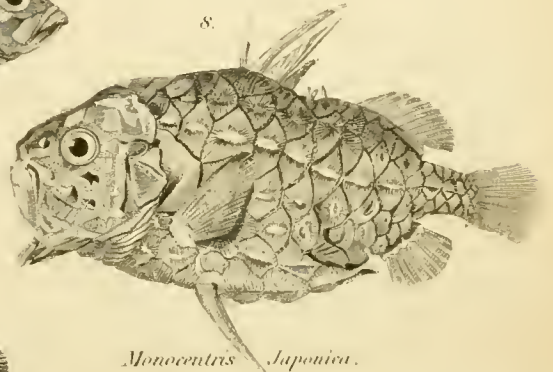
Sebastes variabilis.



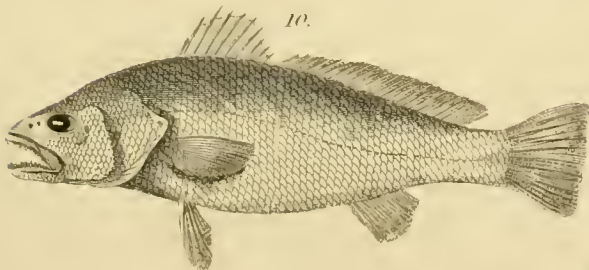
Apistes marmoratus.



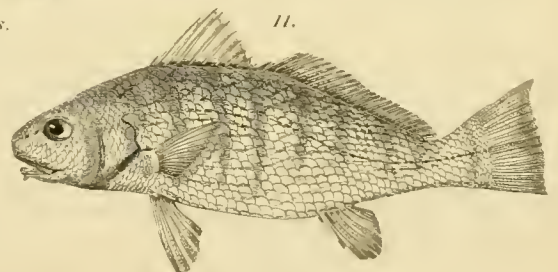
Gasterosteus aculeatus.



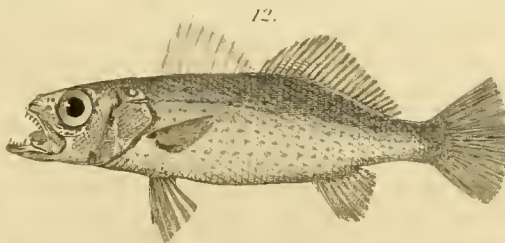
Monocentrus Japonica.



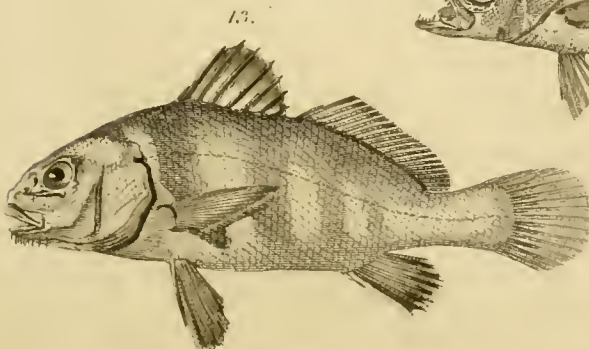
Sciaen aquila.



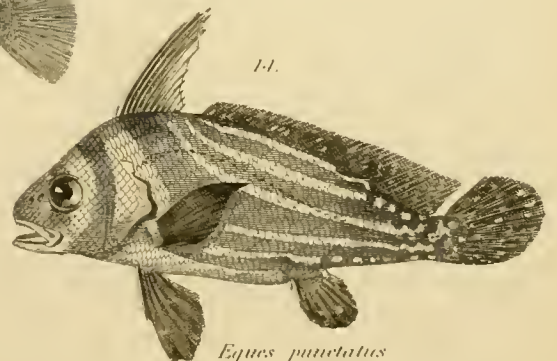
Umbrina coroides.



Corvina dentex.



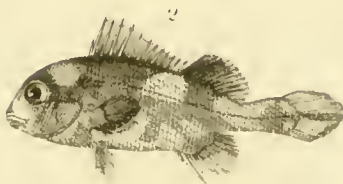
Pogonias fasciatus.



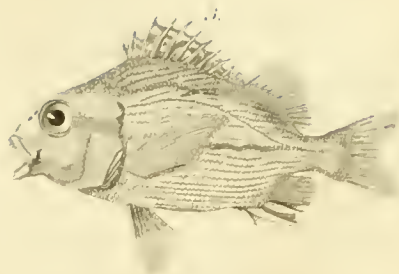
Eques punctatus.



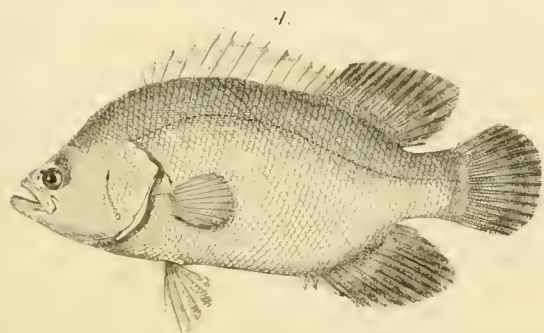
Hemulon quadrilineatum.



Duagrunna orientalis.



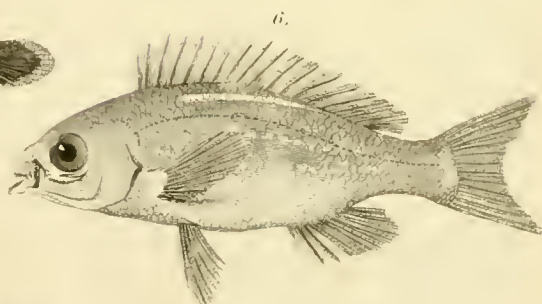
Pristipoma bilineatum.



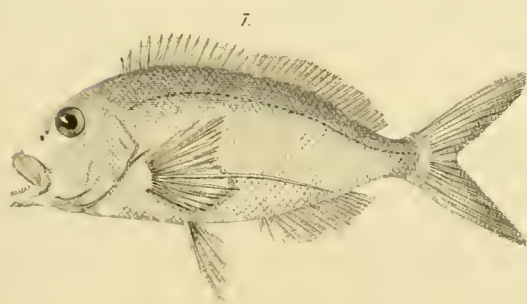
Lobotes sounolentus.



Amphiprion latelavatus.



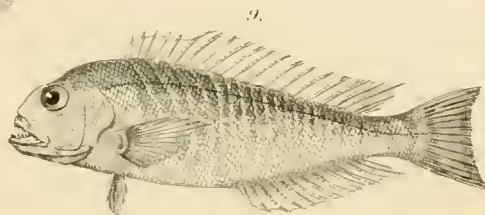
Scolopsides lycogenis.



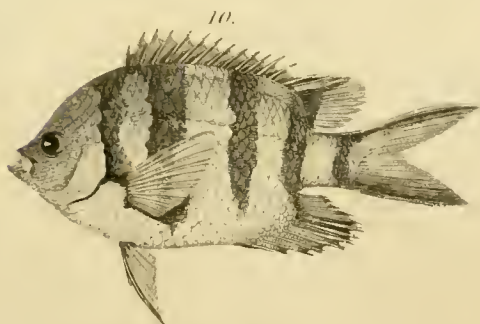
Chelodactylus carponemus.



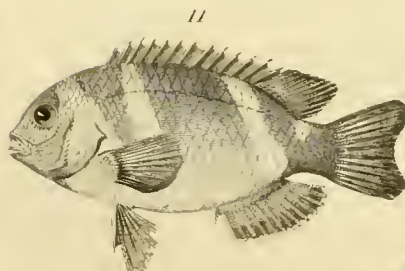
Premnas semicinctus.



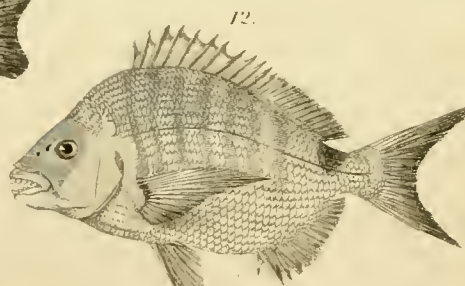
Laticus doloiatus.



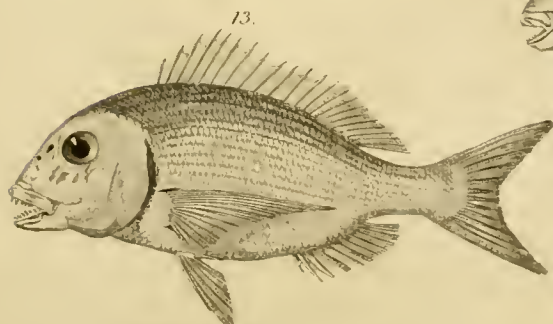
Glyphisodon aetesticus.



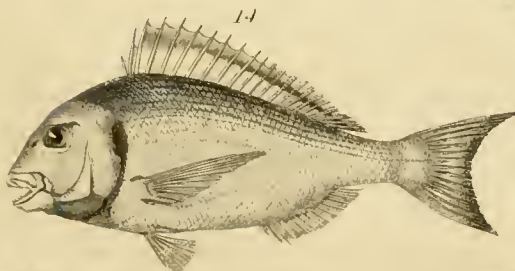
Pomacentrus fasciatus.



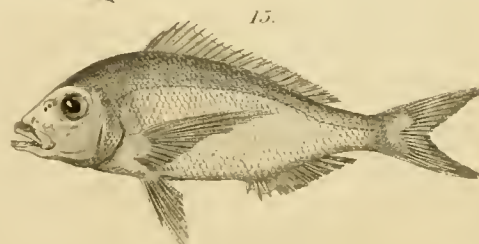
Sargus Rondeletii.



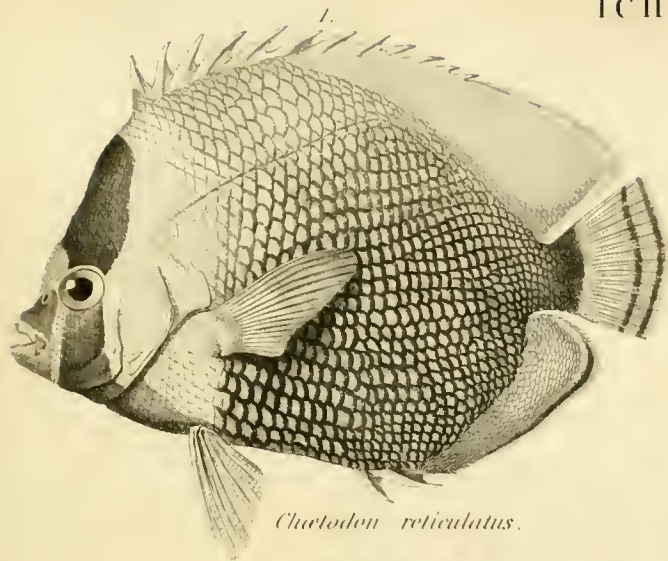
Pugrus vulgaris.



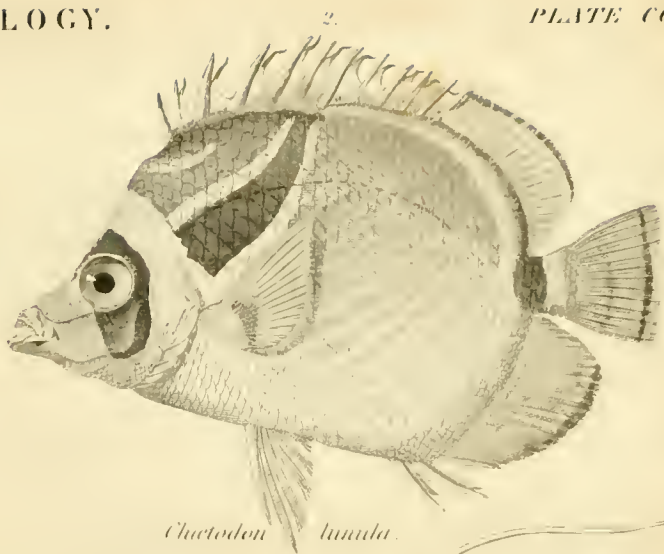
Chrysoplarys aurata.



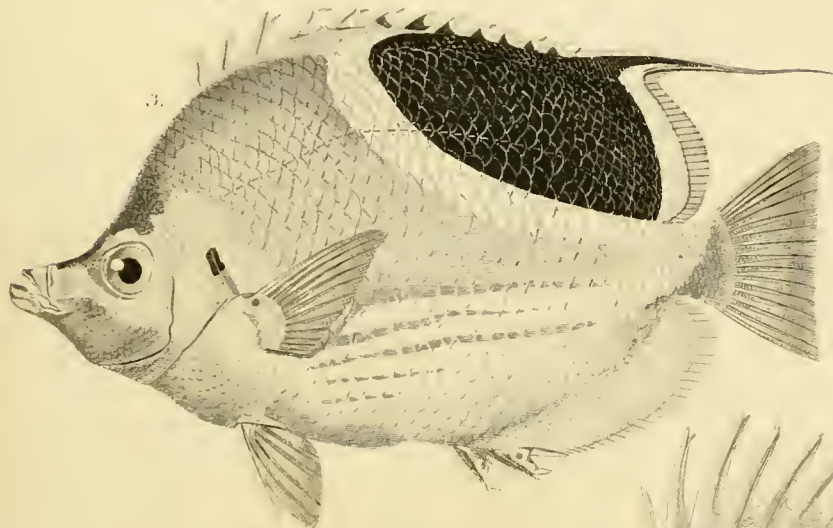
Pugetlus erythrinus.



Thalassodon reticulatus.



Thalassodon lunula.



Thalassodon ephippium.



Thalassochelone monoceros.



Thalassochelone longirostris.



Thalassochelone teira.



Thalassichthys varius.

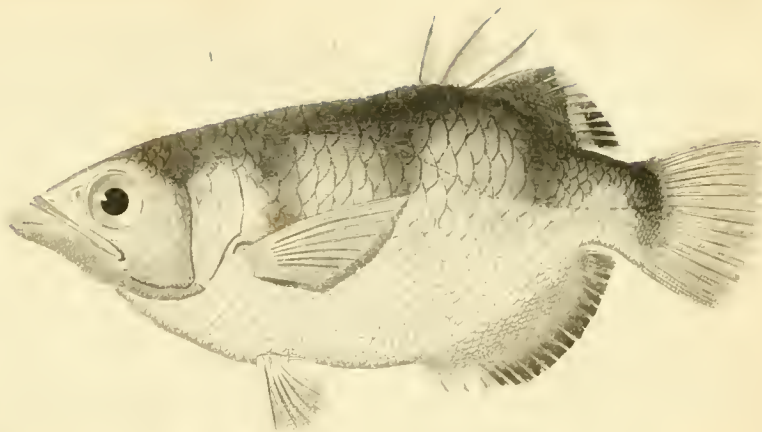


Thalassochelone cornutus.





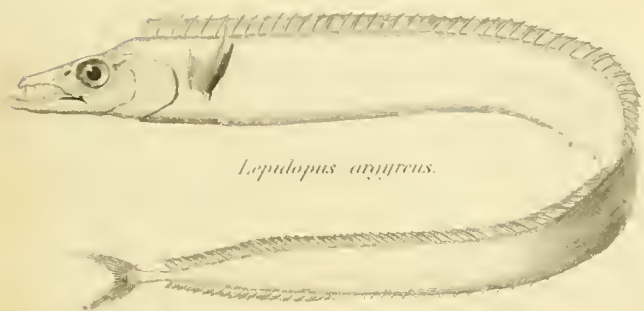
Psettus *Sebae*



Torotes *jaculator*.



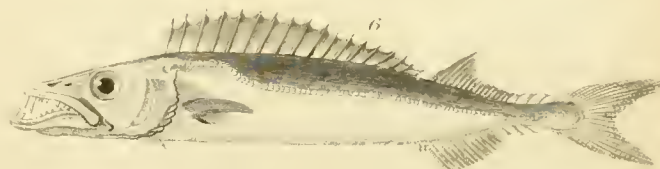
Thynnus *vulgaris*.



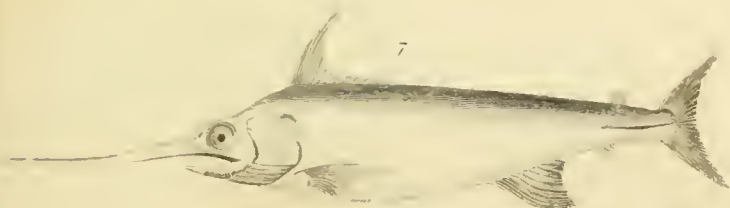
Lepidopus *argenteus*.



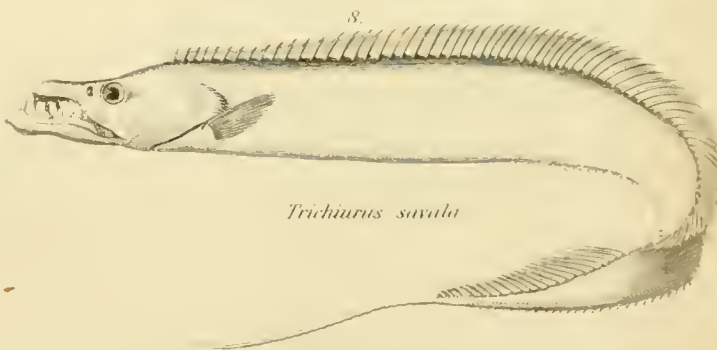
Ancis *vulgaris*.



Gempylus *prometheus*.



Xiphias *gladius*, adult.



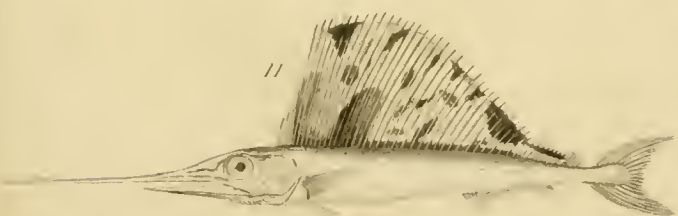
Trichiurus *savala*



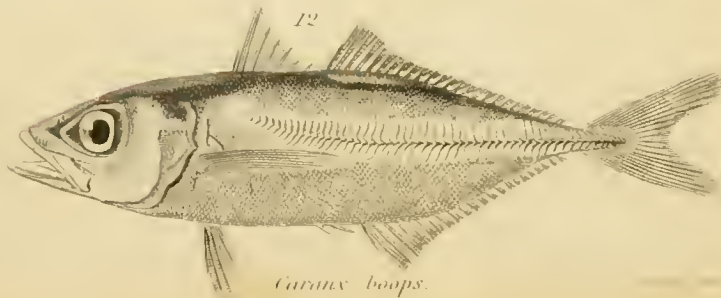
Histiophorus *Indicus*



Xiphias *gladius*, young.



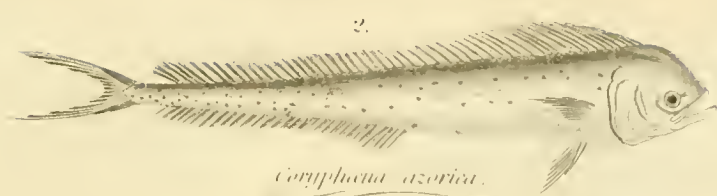
Histiophorus *pulchellus*



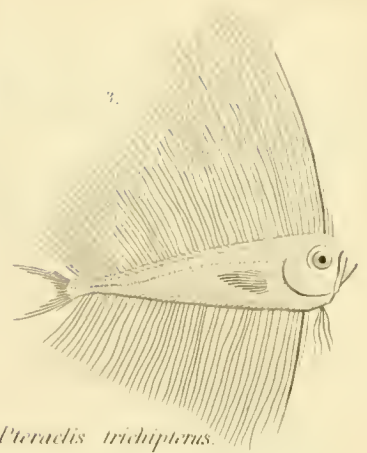
Caranx *boops*.



Callichthys aspioticus.



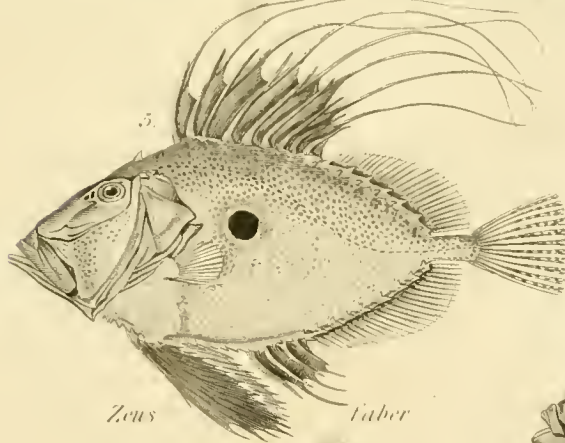
Coryphaena azorea.



Pteraclis trichipterus.



Nomus Peroni.

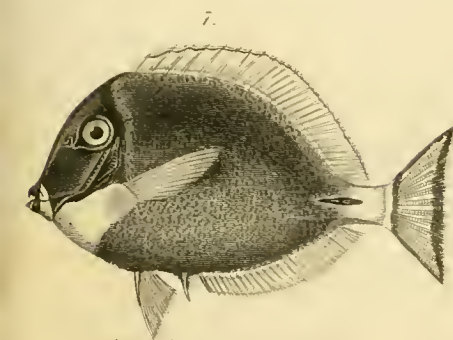


Zeus

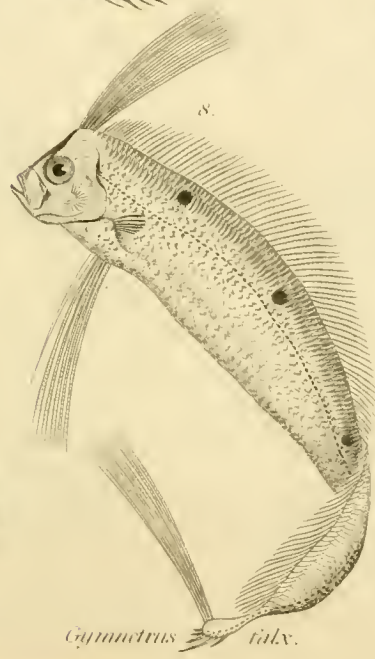
faber



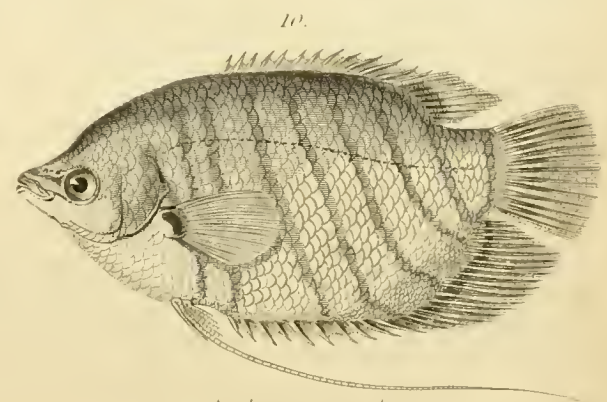
Lampris guttatus.



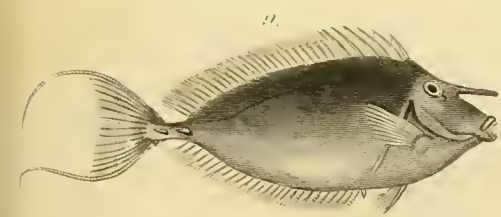
Acanthurus Delisianus.



Gymnetrus faly.



Osphromenus olux.



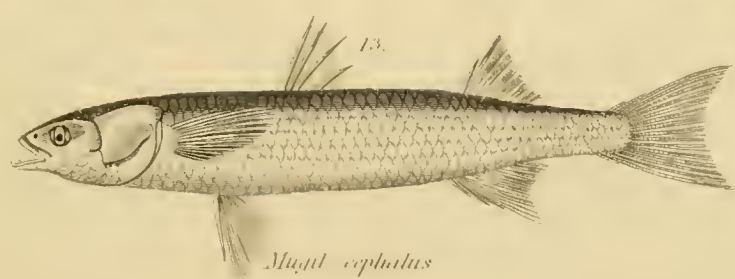
Nasus longicornis.



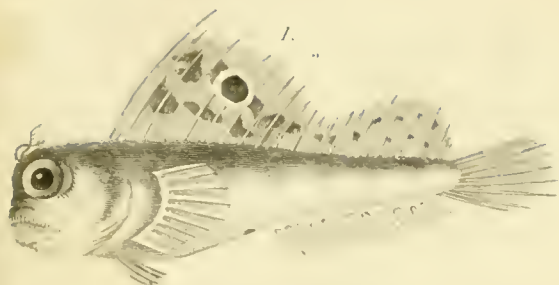
Anabas scandens.



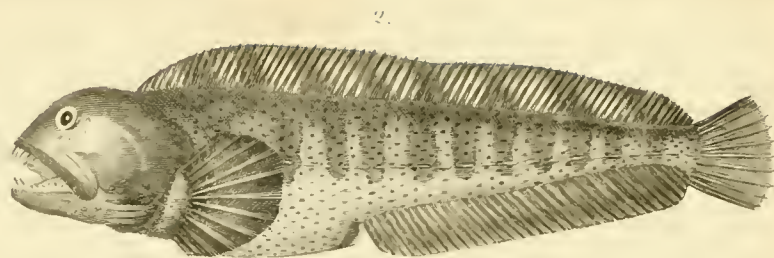
Ophichthys striatus



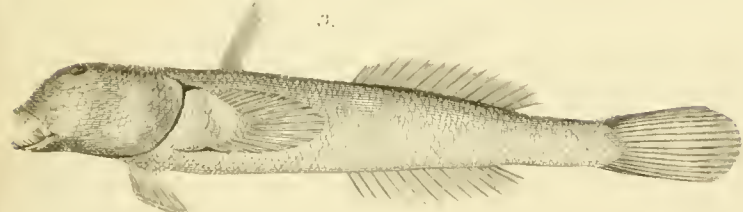
Mugil cephalus



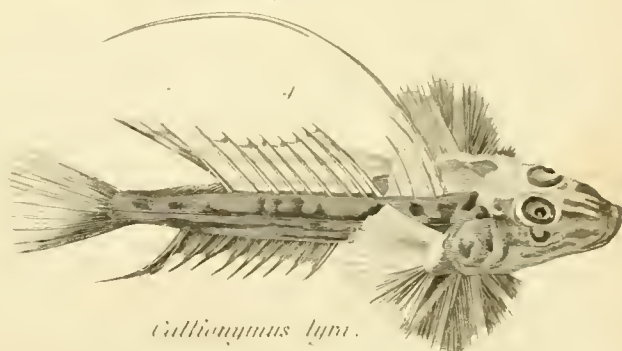
Pleunnus ocellaris.



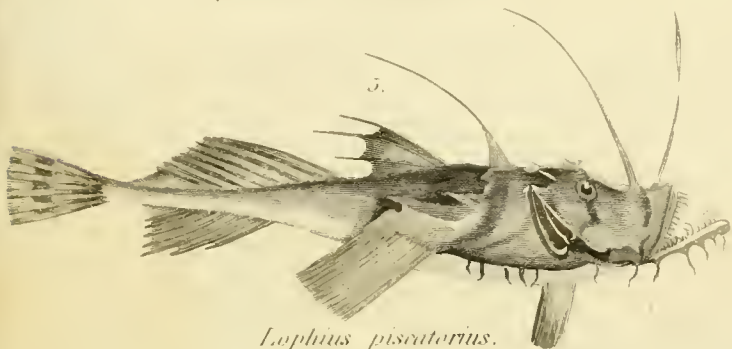
Anarrhichas lupus.



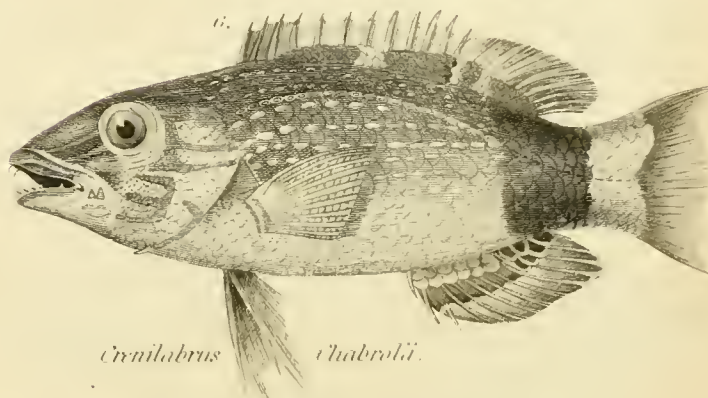
Periophthalmus Freycinetii.



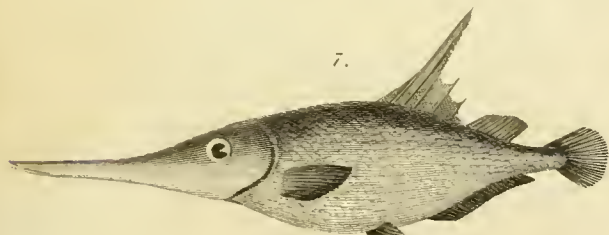
Callionymus lyra.



Lophius piscatorius.



Crenilabrus Chabrolii.



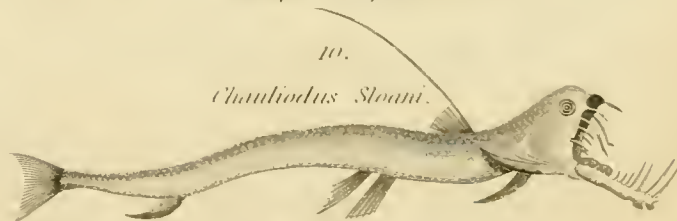
Centriscus Scolopax.



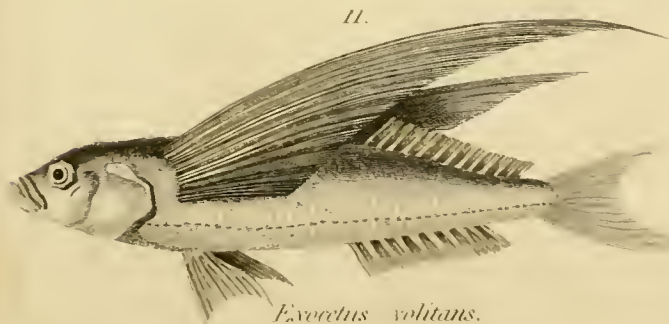
Anableps tetrapthalmus.



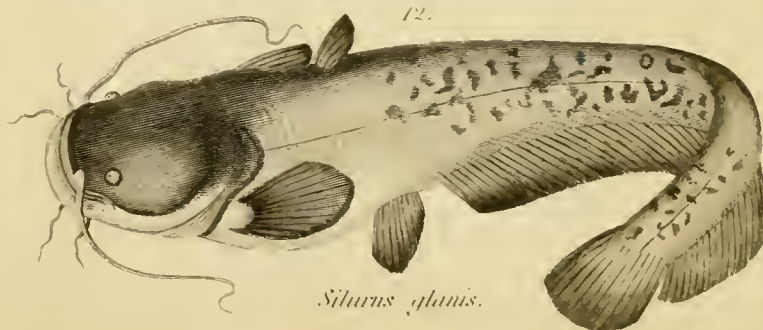
Esox lucius.



Chauliodus Sloani.



Exocoetis volitans.



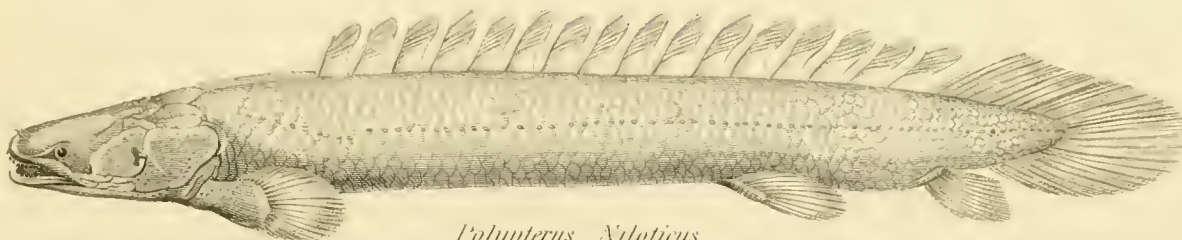
Silurus glanis.



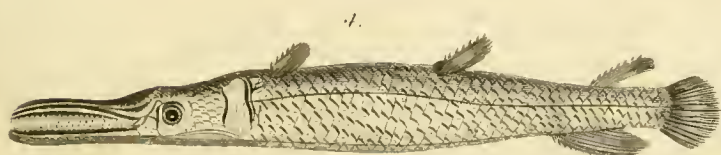
Salmo Canadensis.



Alosa vulgaris.



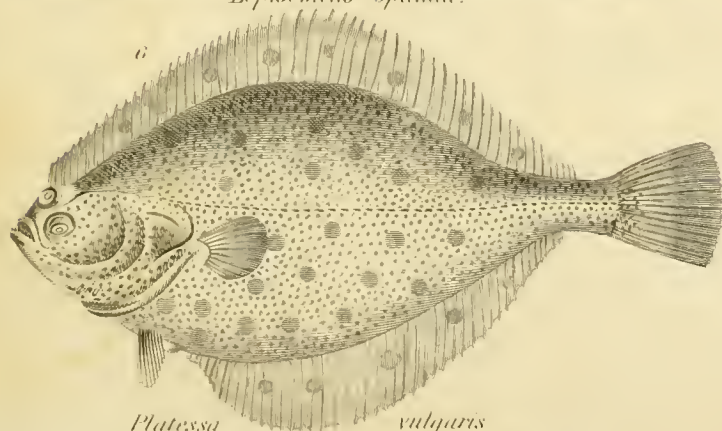
Polypterus Niloticus.



Lepisosteus spatula.



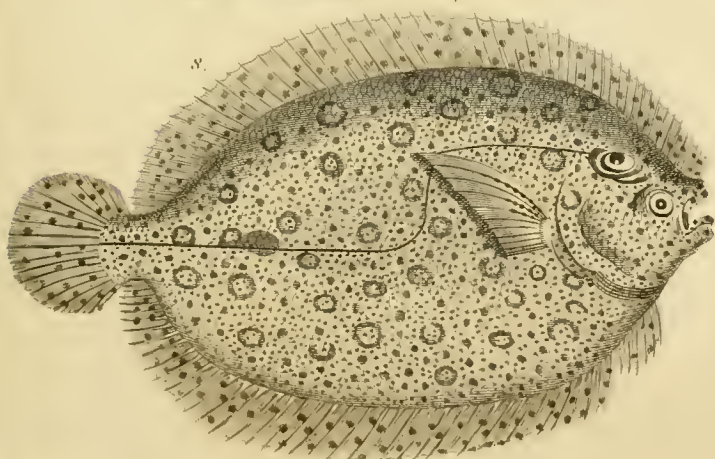
Lota fluviatilis.



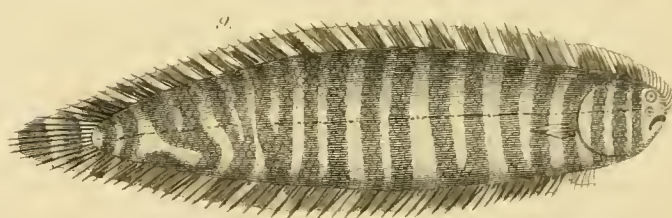
Platessa vulgaris.



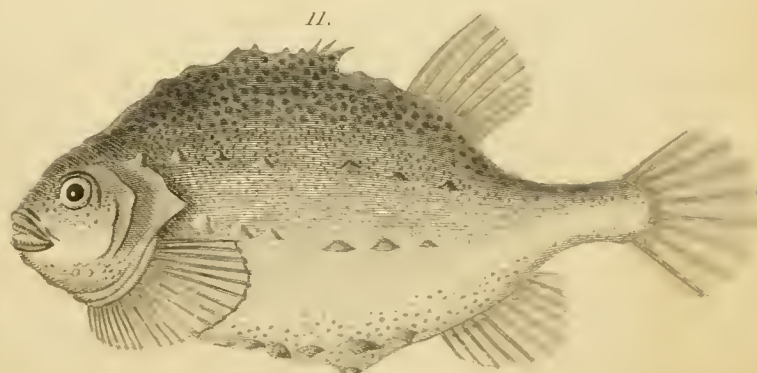
Hippoglossus macrolepidotus.



Rhombus argus.



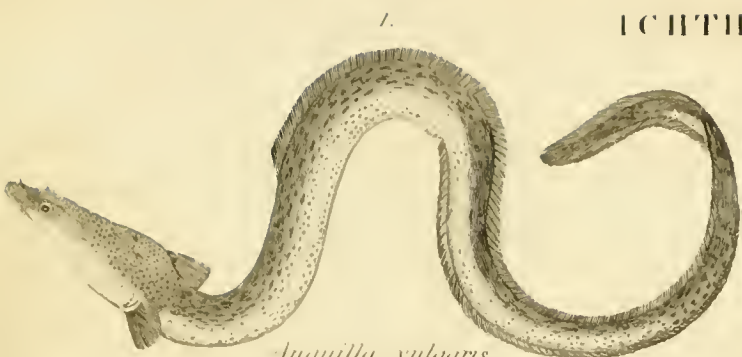
Solea zebra.



Cyclopterus lumpus.



Echeneis naucrates.



Anguilla vulgaris.



Muraena Helena.



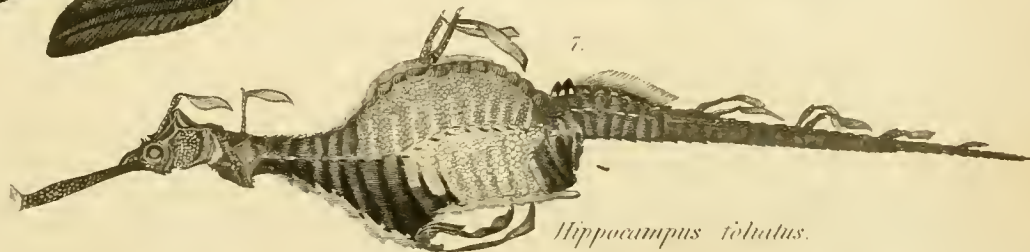
Conger vulgaris.



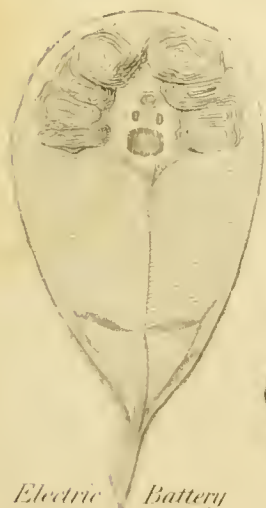
Synbranchus marmoratus.



Gymnotus electricus.



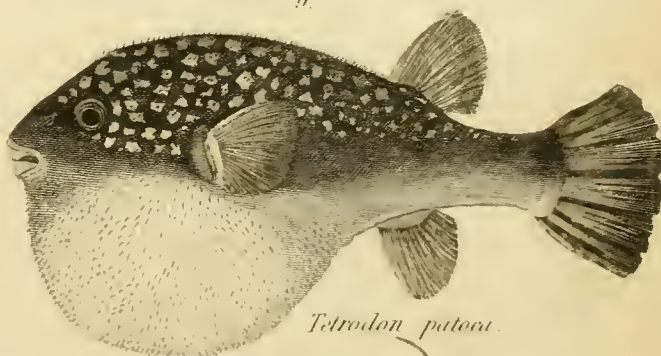
Hippocampus telatus.



Electric Battery of Gymnotus.



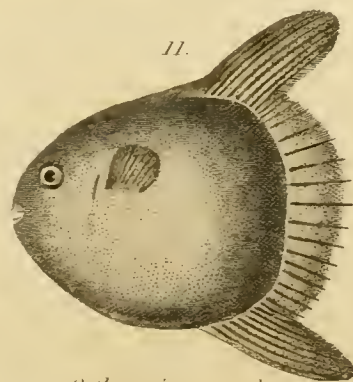
Diodon Atinga.



Tetradon patoca.



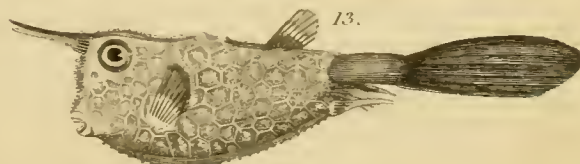
Pegasus draco.



Orthogoriscus mola.



Aluterus monoceros.



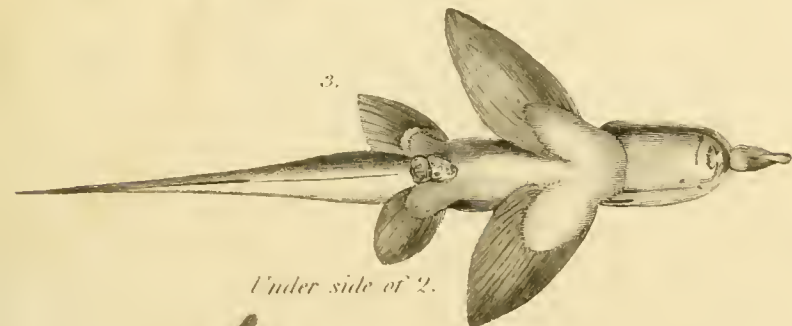
Ostracion cornutus.



Acipenser Ruthenus.



Callorhynchus Antarcticus.



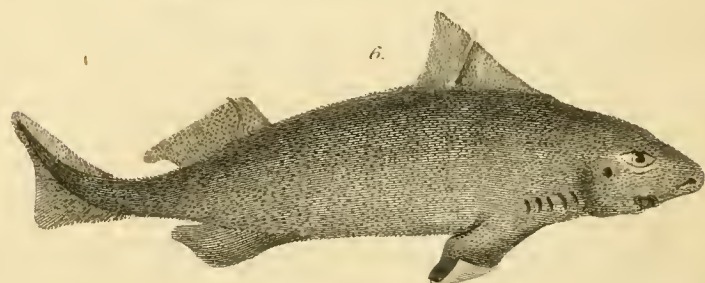
Under side of 2.



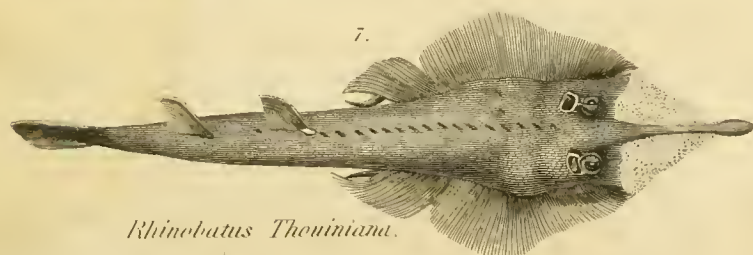
Scyllium fasciatum



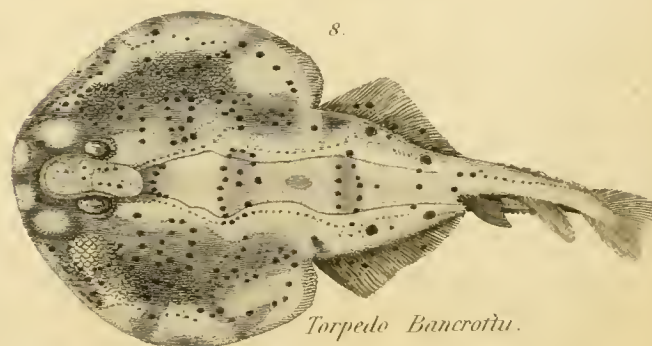
Zygacna Levenii.



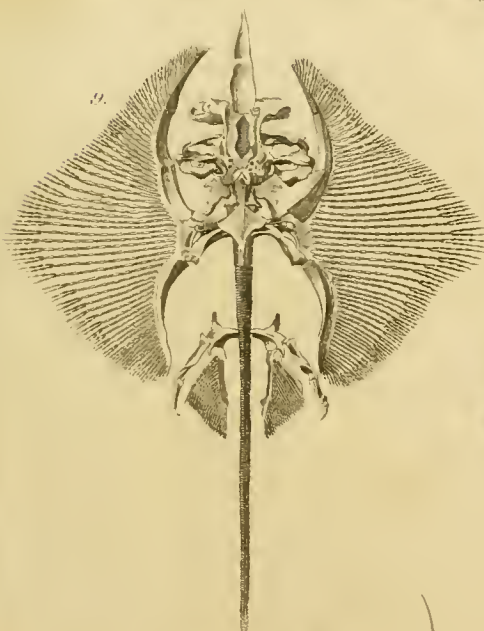
Centrina vulgaris.



Rhinobatus Thouniana.



Torpedo Bancroftii.



Skeleton of Raja clavata.



Alysiobatus pultata.



Cephaloptera girona



Petromyzon marinus, young.



